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AMERICAN AND OTHER PATENTED INVENTIONS.

OCTOBER, 1832.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Alarm to be applied to the interior Flues of Steam Boilers. By A. D. Bache, *Professor of Natural Philosophy and Chemistry in the University of Pennsylvania.*

Both experience and theory point out sources of danger to which boilers with interior flues are particularly liable. As economy will probably lead to the continuation of the use of these interior flues, in boilers of certain sizes, means of safety should have reference to this particular kind of boiler, now in such general use, as well as to those of a different construction.

The objects of interior flues, are well understood. They serve, more or less perfectly, to place the heated gases from the furnace in close proximity to the water of the boiler, and to retain them thus until they can no longer be used advantageously to impart heat. The form, number, and position of these flues are varied to suit the size of the boiler, or the peculiar views of the constructor.

As an example of this kind of boiler, one may be taken in which the draught, after passing under the boiler from the fire end to the back, returns through a flue, within, to the front, where it leaves the boiler. This is a favourable case for safety in this mode of construction, for the flue is not so liable to be unduly heated as when it serves, throughout its length, as a passage to flame. The construction itself, however modified, exposes peculiarly to the danger consequent upon a depression of the water within the boiler below its proper level. The flues, particularly in the small high pressure boilers in which they are

so commonly used, cannot be placed much below the habitual level of the water, and though they present convex surfaces of small diameters, a small depression in the level of the water, after the top line of the flue has been uncovered, exposes a considerable surface.* In such a case, the parts of the exposed surface not adjacent to the water line, being in contact only with steam, which conveys heat from them but slowly, become unduly heated, and, on a considerable increase of temperature, lose their tenacity. If water now obtain access to the heated metal, from any of the causes so often stated, the pressure of the steam suddenly generated must, if the boiler be, from construction or relative temperature, stronger than the flue, cause a collapse of the latter.

When several boilers are placed side by side, and communicate freely with each other, which is the case in many of the boats on our western waters, the careening of the boat,† if sufficiently long continued, as at a landing, &c. will, by partially emptying the boilers on the higher side, produce the circumstances to which we have alluded. The coincidence of such observations with the fact of the occurrence of so many explosions just after leaving landing places, is too striking to pass for accidental.

A large boiler, with flues not in the centre, would be similarly situated with those just described, under like circumstances.

In vol. vii. p. 217, of this journal, I proposed a method by which the fusible metal plate might be applied to steam-boat boilers without risking the safety of the boat, when, under peculiar circumstances, the plate should give way.‡ A plate attached to the boiler would serve only indirectly, if at all, as a means of safety to the interior flues of the kind of boiler which we are now engaged in discussing. A more direct application is wanted to meet the peculiarities of the construction. Besides, the objects to be accomplished in relation to the boiler and to the flue are different. A fusible plate applied to a boiler is intended to act in two different states of the steam within. The first is when the steam is saturated, and has,

* A depression of one inch below the top of a flue nine inches in diameter, and placed horizontally, would expose, for every inch in length of the flue, about 6.1 square inches of surface. A flue twelve inches in diameter, under the same circumstances, would expose rather more than seven square inches, for every inch in length.

For a depression of only one-fourth of an inch, the first flue would expose, for each inch in length, about three square inches, and the second between 3.4 and 3.5 square inches.

† See Williams on "obviating or lessening the accidents incident to Steam Navigation." Journal of Franklin Institute, vol. viii. Also Cadwallader Evans' communication to Committee on Explosions, Journal of Franklin Institute, p. 89, vol. ix. It is due to Mr. James J. Rush, of Philadelphia, that the fact should be known, that he presented to the Committee on Explosions, at one of their earliest meetings, a drawing exhibiting this defect, for which he proposed a remedy.

‡ Since the publication alluded to, the Society for the Encouragement of National Industry, in France, has awarded a silver medal to Edward Hall, of Paris, for an application of the fusible plate which fulfils one more condition than the method which I proposed, and is thus superior to it. I shall take occasion to communicate a description of this invention.

therefore, an elastic force corresponding to its temperature: the second, when from a deficient supply of water, the boiler becomes unduly heated, and communicating its heat to the steam within, the latter is surcharged. In the first case, the plate acts as a check upon the common safety valve and allows the escape of steam when the valve has not done its duty. In the second case, the steam should be suffered to escape only to furnish an alarm, since its continued flow would tend to increase the evil; of the existence of which it had given notice. Means should, therefore, be provided for at once checking the escape of steam in this latter case.

Fusible metal applied to a flue is to act as a warning thermometer, to inform the engineer when, by any accident, the temperature of the flue is raised above the proper point. This taking place when the supply of water is already defective, any escape of steam is objectionable, since it still further diminishes that supply: it is more objectionable than in the case of the boiler, as the relative situations of the surface of the flue and boiler to the water, cause a more considerable extent of surface of the former than of the latter, to be laid bare by a given depression of the level of the water below the top of the flue.

Different methods have been suggested of applying fusible metal to the flues of boilers. It has been proposed to apply a fusible plate directly to the flue: to such a plan the strongest objection is that the contents of the boiler would be discharged, with more or less violence, through the opening made by the fusion of the plate, even if the water were below the level of that opening. If this should fail, in the case of a high pressure boiler, to produce the destruction of human life, it would, in all cases, expose to the delay necessary to a complete cooling of the boiler, and to the replacing of the plate; it might occur at a time when the desertion of the prime mover would be as dangerous as an explosion.

Arrangements which require the access to the boiler to be cut off by stuffing are, in general, bad, when the parts passing through the stuffing box are to serve as an alarm, and are to be moved only at distant intervals, exposing them to adhesion from change in the packing, or from oxidation. The proposal of an anonymous author to apply to the flue a mass of fusible metal, in which the lower end of a rod should be fixed, the upper end passing through a stuffing box on the boiler, is liable to this objection. Besides this, however, there are others, foremost among which stands the effect of galvanic action, which, according to the metals used, would oxidise the flue itself, the rod, the fastenings of the fusible metal, or one or more of the components* of the alloy.

The tubes terminated by fusible metal, proposed by Mr. Ewbank,†

* The order in which iron and copper, the materials of boilers, rank with lead, tin, and bismuth, the components of fusible alloys, in the electrical series, is as follows: copper, bismuth, tin, lead, iron, the last named being electro-positive with regard to those which precede it. (Berzelius, traité de Chimie, tome iv. p. 571.

† Journal of Franklin Institute, vol. x. p. 1.

are, in my opinion, superior to either of the methods just examined: by extending them to the vicinity of the flue they might be so prepared as to melt when it should become unduly heated: the tubes being small, the escape of steam would not be important. The tubes would be exposed to the effects of galvanic action, and when the ends were once fused, could not, conveniently, be renewed while the boiler was in action.

The following apparatus combines the requisites of giving warning when the temperature of the flue reaches a determinate limit; of not producing, necessarily, the escape of steam; of being free in its action; and of being renewed with great ease, after having given warning.

A tube of iron or copper, closed at the lower end, passes through the top of the boiler, its closed end reaching the flue, to which it is attached. The material of the tube will depend upon that of the boiler. This tube, it will be observed, affords a ready access to the flue, to ascertain its temperature, without any restraint from packing. Such tubes were used by Dulong and Arago in their experiments on the elasticity of steam at different temperatures, (and, also, by the committee of the Franklin Institute on Explosions,) to ascertain the temperature of the steam and of the water within their boiler. For this purpose, they were partly filled with mercury, into which a common thermometer was plunged, and thus conveniently placed or removed while its bulb was not exposed to the pressure of the steam.

A mass of fusible metal placed at the bottom of the tube, described in the beginning of the last paragraph, will become fluid very nearly as soon as the flue takes the temperature of fusion of the alloy. I would, in passing, note a point in relation to fusible alloys which is of great consequence in these kind of applications, and which, from some experiments, I have reason to believe may be attained; namely, that the proportions of the component metals should be so adjusted that the alloy will change its state, from a solid to a liquid, without going through a series of slow gradations.

The alloy contained in the tube might have its fusing point at thirty degrees Fah. above the working temperature of the steam. This, for a low pressure engine, working at two atmospheres, would allow a range of more than one atmosphere above the working pressure, before it fused; putting out of the question the fusion of the metal by ordinary variations in the temperature of the water surrounding the flue. In a high pressure engine working at eleven atmospheres interior pressure, the fusing point of the alloy being placed at thirty degrees above the working temperature would not exceed 397 degrees Fah. Larger limits might be taken without incurring danger, should practice show that these are inconveniently small. The object not being to give notice when the steam is saturated and highly elastic, and the water, therefore, the same temperature as the steam, the fusing points of the alloys should be considerably above those of the plates attached to the boiler, and above the temperature corresponding to the pressure for which the safety valve is loaded. The case to be met by the apparatus is that in which the flue itself becomes unduly heated.

To show when the metal at the bottom of the tube becomes fluid, a stem is attached with a cord and weight, or, as shown in the annexed cut,* with a lever and weight. The weight and longer arm of the lever, in descending, may be made to ring a bell, or, by appropriate attachments, to turn a cock, permitting just enough steam to issue to give the alarm, and then to be closed at once. A projection on the lower end of the rod prevents it from being drawn from the metal until this latter is fused, and by widening the lower part of the tube, making it slightly tapering, the metal is kept from being drawn out by the rod.

When the alloy has fused, indicating an undue heating of the flue and its cause a defective supply of water, it is only necessary at the time of giving the required supply to remove the weight and return the rod to its position in the fusible metal, which, as it congeals, will enclose it: by replacing the weight the apparatus is again prepared to do its duty. The solidifying of the metal will show when the temperature of the flue has been duly reduced. Should this be ascertained by sounding with the rod itself, it might be drawn out just when the metal was in the act of congealing, and thus its return to its place be prevented. This would destroy an important quality of the apparatus, and to avoid such a chance a wire should be provided with which to sound, for the purpose of ascertaining the state of the alloy. In the event of such a mischance, or of any circumstance which should solidify the metal before the rod could be returned, it is not difficult to see how the small quantity of alloy might be rendered entirely fluid: such a case, although it should be provided for when accident may produce it, should be avoided by the attention which would almost insure its non-occurrence. I have spoken of the melting of the alloy as indicating a deficiency of water in the boiler, since this would generally be the cause producing its fusion. Another cause should not be passed without mention, as it may lead to a peculiar location of the tube, namely, the effect of the sediment sometimes allowed to deposit upon the flues. This sediment interposes a stratum of imperfectly conducting matter between the metal of the flue and the water; the heat thus prevented from passing to the water, accumulates in the flue and leads to a dangerous state of things. These circumstances ordinary care may prevent, and in the intermission of that care notice of the approach of danger may be derived from the action of the alarm. Such a case is an extreme one, requiring nothing less than a cleansing of the boiler to remove risk; the checking of the fires, if not their extinction, should follow a warning given, when the water was ascertained to be at its proper level, or when the introduction of more water did not cause the alloy to recongeal. It cannot be expected of any device to provide a remedy for the negligence which would allow the accumulation I have supposed; a notice of its existence would be neglected at the peril of all concerned.

Unless a boiler be made of very undue thickness, never the case

* See page 223.

in practice, the metal itself can hardly oppose sufficiently the passage of heat from the parts in contact with the flame to those in contact with the water, to produce any dangerous accumulation of heat.

In determining the position of the tube reference should be had to the construction of the boiler. If the flue be inclined, the proper position for the tube, intended to meet the case of undue heating from a deficient supply of water, would be upon the higher part, as likely first to be laid bare. In reference to the deposit different modes of construction would require different locations, which might render necessary a separate apparatus from the former.

For the use of the engineer, a second tube may be provided, at the side of the first, to contain an alloy fusing at a low temperature,* or mercury when it could be used, into which a thermometer being plunged would show the temperature of the flue. A similar device, already alluded to, being conveniently placed, will give him the temperature of the steam within.† If a thermometer be deemed too fragile an instrument to be used in this place, an alloy less fusible than the one used in the proposed alarm, may be similarly applied, its indications being given to the engineer alone. Before referring to the cut for a detailed explanation of the apparatus which has been, in a general way, described, it may be well to pass in review some of the points which should meet with attention in its construction.

Of the first importance is to be considered the connexion of the tube with the flue so as to prevent the introduction of sediment between them. This may be accomplished, among other ways, by providing a projection at the bottom of the tube over which a ring being passed (as shown in the cut) and secured to the flue, will attach the tube closely to the latter. If the tube, thus connected with the flue, should pass by a screw joint through the top of the boiler, any change in the position of the flue would tend to separate the attachments of the tube or the parts of the tube itself. To provide against this the tube should pass through a stuffing box on the top of the boiler; this would allow it to move, the fastening to the flue remaining firm. This box, it should be observed, is in nowise connected in its action with the parts of the alarm. The movement of the tube will render necessary a small allowance in the position of the lever with respect to the bell.

The tube should be made as small in diameter as is consistent with the free action of the rod. The water is excluded from the space on the flue occupied by it, and if this space were considerable the temperature of that part of the flue would be higher than that of the rest. The tube must be so small that the metal may not fuse when the flue is covered with water.

If a bell be used in connexion with the stem and lever, the weight attached to the longer arm of the lever should enable it to raise the

* Two parts, by weight, of bismuth, and one of tin, give an alloy which fuses at 200 degrees Fah. The fracture of the thermometer by the congelation of the alloy, in an open tube, need not be feared.

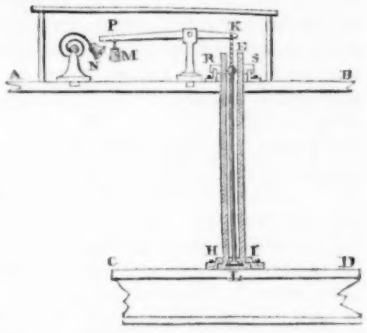
† The use of the thermometer has been most judiciously insisted upon by Professor Renwick in his work on the steam engine.

rod, and to overcome, with certainty, the resistance of the spring to which the bell is fastened.

A cover should be used to prevent the access of rain to the tube, and the whole apparatus should be inclosed in a grating that it may not be tampered with; the captain of the boat should have the key of this grating.

If this apparatus were applied to the connected boilers of our western boats, the frequency of the action of the alarm, when the flues become bare by the careening of the boat, might lead to a neglect of its indications. The apparatus would then merely give notice of what ought to be known without it, namely, that the higher boiler, or boilers, have a defective supply of water and are becoming unduly heated.* That these circumstances are not always accompanied with danger no one contends, and that some plan must be adopted by which the evil spoken of may be remedied is as clearly admitted. As long as human life is thus trifled with by permitting the known and frequent recurrence of danger, alarms of any kind must be useless. The defects incident to these boilers† must be remedied before this or any other alarm can be usefully applied to them.

Annexed to the cut, which follows, are references giving a more detailed description of the apparatus.



A B is a section through the top of a boiler; C D, a corresponding section of its flue. E H represents a tube closed at the lower end, which is attached to the upper side of the flue. The mode of attachment by a projection on the tube and a ring screwed to the flue, is shown in the cut; as also the stuffing box, R S, through which the upper end of the tube passes. The lower part, H I, of the tube, is made tapering, to retain the fusible metal. K L is the stem, the lower part being inclosed by the fusible metal, the upper part attached by a chain to a lever K P. The weight M draws the rod K L upwards, and on the fusion of the alloy H I, carries the lever below the bell N, which, being attached to a spring, rings an alarm. The apparatus is inclosed in a grating; that part of the top which is above the tube should be so made as to prevent the admission of rain to the tube.

* For this, and other judicious remarks, I am indebted to the kindness of a friend, to whom a description of the apparatus was submitted before publication.

† For proposed remedies, see the papers of Messrs. Williams and Evans, before referred to.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Practical Observations on the good and bad properties of the Colours used by Artists. By JOSHUA SHAW.*

(Continued from p. 10, vol. ix.)

In pursuing my observations on colours, I shall next notice that denominated Antwerp blue, which consists principally of cobalt, apparently in a semi-vitrified state, combined sometimes with alumina and sometimes with Prussian blue, generally with the latter, which forms about eight, or from that to fifteen per cent. of the article of commerce. It is extensively used by the manufacturers of paper hangings, and has within a few years, got into some favour with the artists. It is not so opaque as Prussian blue; and on the whole is a preferable colour; it is very manageable and pleasant to use; when reduced with white it exhibits an inclination to green, more or less; the very best to be met with has this failing. Portrait painters make a free use of it in their draperies, and frequently depend upon it for the gray tints of the flesh, combining it with Indian red, brown ochre, calcined vermilion or lakes. It should never be used except for draperies, the green foliage of trees, or such objects as have no standard by which its liability to change can be detected. In flesh tint, where the carnation merges into gray, there are very few colours indeed which can be relied upon, however carefully attended to, and that do not, in the course of two or three years, verge into a green, destroying the entire effect, and giving the subject a sickly appearance.

The only unchangeable blues are, first, the ultramarine, or ultramarine ashes, the latter, however, is for the most part liable to objections which I shall notice under its proper head. In my preceding observations, I have mentioned indigo as a valuable substitute for Prussian blue, and I shall here introduce it again as a substitute for ultramarine ashes. I have made many experiments with it, and all of them go to prove it a most valuable colour. Once being short of both ultramarine and the ashes, I charred some fine Spanish indigo in a crucible, which I afterwards ground in oil, and ventured to use it, at risk, and found, after several years, that it fully answered my expectations. When combined with white, it as much resembled the ultramarine ashes as could be well imagined, and it suffered no visible change after many years; I tried it in every possible way to put it to the test, and it still continued the same; it was not affected by the sun, and to this day I have recourse to it whenever I am short of the only superior article, ultramarine, or good ashes. If, therefore, economy is to be the order of the day with artists, it may, in the absence of the other, be relied on as a safe colour for the gray

* The first essay under this title will be found at p. 10 of the last volume; an accident which happened to the writer has retarded the appearance of the second, and his absence from this country will occasion some delay in their continuance; it is his design, however, to complete the series as early as circumstances will allow.

and pearly tones which are so frequent, and which form such an exquisite variety in the fairest complexions of the softer sex.

I once had occasion to copy a fine landscape by David Terniers, and it was the only colour by which I could truly imitate his chaste and silvery tints; reduced with white it matched most exactly the silvery blue sky, and broken with fine calcined Roman ochre it made the dark cloud tints, the distances, &c. &c.

But to return, Antwerp blue, like Prussian, may be occasionally used in broad draperies broken with white, after the manner previously recommended in the use of the latter, and rendered very permanent by a thin transparent coat of ultramarine glazed over it. It is nevertheless but an indifferent article to rely upon as a universal attendant on the palate, and should be confined to foliage, broad draperies, &c. &c.

The next blue, in respect to rank, is Cobalt blue, as it is called, but which assumes a great variety of forms, and is not always in commerce the true or genuine article. Fine blue pigments have of late years been much speculated upon, and chemists have made many discoveries, some of which are very valuable, having produced colours contending for rank with ultramarine ashes; others again are but sorry imitations of cobalt, and by which the young and inexperienced artist is frequently duped both of his money and reputation. I shall, however, in my next, endeavour to put him in possession of such facts as will assist him in the choice of this article, and the best mode of applying it in practice.

If, in my explanations, I have apparently digressed a little from one subject to another, I have done so for the sake of comparison, and with a view to assist the artist, who will, perhaps, understand me better than he would were I to attempt a perfectly methodical arrangement, or trite classification of the materials described. I am very sensible that men of science may consider my essays as too desultory, but if I am understood by those for whom I write, I shall at least render them a service, and in so doing shall have accomplished every thing which I proposed when I undertook my present task.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

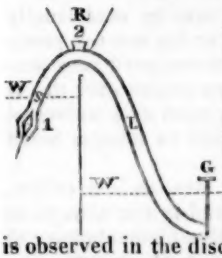
Proposed Improvements in the construction of the Syphon.

The following remarks relative to some proposed improvements in the construction of the syphon, is submitted to the consideration of the committee on publications by DANIEL LIVERMORE.

The operation of the syphon when made on a large scale is liable to obstruction by an accumulation of air within, which prevents the continuity of the water near its summit. This defect may in a great measure be obviated by the following arrangement. Place a valve near the lower end of the shortest leg, to open upwards, and another smaller valve on the top of the syphon, likewise opening upwards, and enclosed within a funnel shaped reservoir, the passage from

which to within the syphon is closed by shutting the valve, or when open the water may be admitted from said reservoir, and retained within until the syphon is filled; the outlet being closed by a gate or sliding valve fitted to the end of the longer leg, which remains shut until every thing is ready for operation.

The manner of operation will be more readily explained by reference to the annexed sketch.



Let the dotted lines W, W, represent the surface, below which S and L receive and discharge the water.

The stop gate G being closed, and the valve 2 open, the syphon is filled by pouring water in at R. When full the valve 2 is placed on its seat, and covered by the water left in R, to prevent the admission of air. G being raised, the water ascends through S, and descends L to the outlet. If any considerable diminution is observed in the discharge, we may conclude it is occasioned by an accumulation of air within the syphon.

By closing G the valve 1 will likewise be closed, but before this can be effected, if the stoppage at G be sudden, a concussion is produced by the continued action of the water, which forces itself with any air which may be within, through the valve 2, leaving the syphon free to act with renewed energy. The valve 1, if made in the form of a double cone (as here represented,) and properly proportioned, gives, when opened to the extent permitted by its tail piece, an undiminished water way, without *increasing the internal area* of this section of the syphon. This I believe is considered desirable by philosophers, but in many cases a contraction of the water way is not so important but that a plain valve of ordinary construction might be substituted. For most practical purposes the syphon is made on a small scale, and the outlet may more conveniently be closed by a stop cock than with a sliding valve.

The entrance and discharge of the water might be considerably facilitated by adjutages of proper construction; and for a syphon on a large scale, may probably be applied with considerable advantage.

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

(No. XXIX.)

New York, July 30, 1832.

TO THE COMMITTEE ON EXPLOSIONS.

GENTLEMEN,—Presuming that some account of the recent disaster on board the steam-boat Ohio, would be acceptable to you, the following is respectfully submitted. As I believe this explosion was the natural consequence of a defective construction or arrangement

of the internal flues, and as the same plan is adopted in nearly all our new boats, and in a majority of all others belonging to this city, it is of immense importance that the true character of this "*plan*" be ascertained and made known.

Very respectfully,
THOS. EWBANK.

Explosion of one of the boilers of the Steam-boat Ohio.

An explosion occurred in one of the boilers of this boat on Friday evening, July 6, when near Sing Sing, on her passage hence to Albany, by which five more of our citizens have perished. This is the fifth disaster of the kind reported in the course of the present year, and every one of which, it is believed, accompanied with loss of life.

I precede my remarks upon this explosion by a letter from the captain of the boat to the editors of the daily papers, and by the testimony given before the coroner's jury.

"*Steam-boat Ohio, July 7*, 1832.

"GENTLEMEN,—On our passage up yesterday afternoon, an accident occurred on board of the boat under my command which is much to be deplored. A short distance from Sing Sing, while under a common head of steam, and plenty of water in the boilers, a rent occurred in the steam chimney of the starboard boiler. The steam and water rushed out of the boiler, and, melancholy to relate, scalded three of the passengers. Every attention was shown to the sufferers, who died before morning. Their names were John Connor, of Albany, William Farnham, of Greenbush, and Eli Bower, of Poughkeepsie; also two of the crew, Samuel M'Mullen and Rob. Steward, are missing, who, it is presumed, jumped overboard.—These are the only persons missing, as far as I can learn. There were upwards of three hundred persons on board, part of which went to Newburgh in the Experiment, and the remainder returned with the boat to New York. As there was no other boat out last evening there was no occasion for an extra head of steam. The injury to the steam chimney can be repaired in a short time, and she can take her place, and leave here on Monday afternoon for Albany at 5 o'clock.

MARTIN BARTHOLOMEW, Master."

"Captain Bartholomew, commander of the boat, testified that he left this city last evening, for Albany; when about thirty-six miles from this city, he heard an explosion which he immediately ascertained had been caused by the bursting of the steam chimney; this was about fifteen minutes after 8 o'clock, last evening; in consequence of the bursting of the chimney, the water was forced back through the return flues and out the door of the furnace.

The names of the deceased persons now on board, are John Connor, of Albany, aged 30 years; Wm. Farnum, of Greenbush, aged about 26 years, and Eli Brower, cloth manufacturer, of Poughkeepsie, aged 40 years. The first two named were lieing on the skylight

which covers the cabin, exactly opposite to that part of the furnace through which the water rushed. Mr. Brower was standing near the same place. The boat was under a moderate press of steam, about fourteen inches; the boat often carries eighteen inches, and sometimes twenty, with perfect safety; they sometimes proceed with less steam than fourteen inches, when no more can be had; there was a sufficiency of water in the boiler, as one of the men who examined can testify; the chimney was iron, and was placed there new last season; the chimney is always expected to last as long as the boiler, which is about five years: the boiler was overhauled a short time since.

Two other persons besides those now on board dead, are lost; they were hands on board; their names were Samuel M'Mullen and Robert Stewart; they leaped overboard and were drowned before efficient aid could be rendered to them.

Peter Mathews, a fireman on board, testified that there was fifteen inches of steam on—he had just tried the quantity a minute before the accident occurred; the boat frequently carries seventeen inches, a quantity which is perfectly safe; does not recollect to have seen her carry twenty inches; has been in her about two years; the chimney was considered in good order.

Nathaniel Cornell, a hand on board, examined the water about five minutes before the accident occurred; there was then enough in the boiler; however, added some more, so that the accident could not have been caused by any insufficiency of water in the boiler; witness examined the chimney about two weeks since, it was then in good order.

Marcill Manning examined the chimney about a week since, it was then in good order; a patch was placed on one side of it about seven days before; it was not at the part repaired that the chimney burst, but much lower down, and on an opposite side.

Alexander Homestrum, the engineer, corroborated the testimony of the other witnesses as to the state of the steam and the water.

In addition to this testimony, the jury examined the bodies on board, and also the state of the chimney and boiler, and returned a verdict that the deceased persons had been scalded to death in consequence of the accidental bursting of the steam chimney on board the Ohio."

It is to be regretted that when disasters of this kind occur, inquiry is seldom instituted with a determination to ascertain the cause *any further than as it may implicate the captain, or the engineer and his attendants.* When no blame can be attached to them, the explosion seems to be looked upon as a mystery too dark to be scrutinized, and little or no effort is made to explore it. The rupture is repaired, and the boat runs again as before. Public excitement is transient, and the occurrence is soon forgotten except by the relatives and friends of the sufferers.

So long as this continues to be the case, there is no security that hundreds more of our citizens will not be hurried out of existence by steam-boat explosions. These awful occurrences cannot be

prevented except by removing the causes of them. And how can they be removed, while these remain unknown?

That the primary cause of the present explosion was not known to the captain, may be inferred from the latter part of his letter, where he says "the steam chimney can be *repaired*, and the boat take her place on Monday;" and that it remains equally unknown to the owners and others concerned, would appear from their merely repairing the ruptured flue, (which they are doing,) without altering in the least its internal arrangement.

By referring to page 131, vol. ii. of the Journal of the Institute, the committee will find the origin of "steam chimnies;" but as no description sufficiently definite is there given of one, I have enclosed a sketch of that of the Ohio.*

Fig. 1

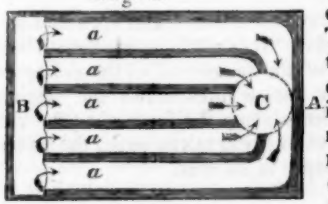


Fig. 1, is a plan of the flues and bottom of the boiler. A is the front end, at which the fuel is applied. The flame passes under the bottom to the other end, where it is received into the box or case B, which is open at its under side. The horizontal flues *a*, *a*, *a*, *a*, *a*, are connected with the case B; and their other ends lead into C, the main flue, which passes vertically through the boiler, (see fig. 2.) The dark parts in fig. 1 are spaces left between the sides of the boiler and the flues, and between each of the flues, and are occupied by water. The arrows show the direction of the flame.

Fig. 2

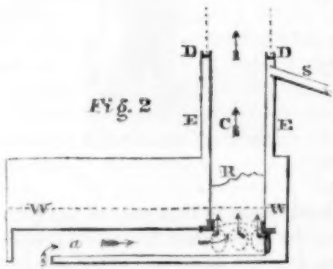


Fig. 2, is a longitudinal section of the boiler. C, is the ruptured flue, its upper part enclosed in another tube E, E, called a "*steam chimney*," attached to the top of the boiler, and forming part of it. A space is left all round C of 6¾ inches. E, E, and C, are united at D, D, and made steam tight.

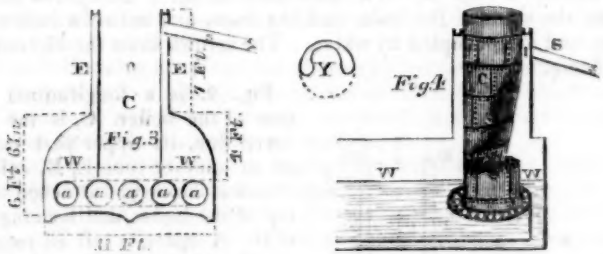
The chimney proper is merely slipped on C at D, D, and held to its place by braces. At the upper

* In the course of conversation with an intelligent engineer who assisted me in obtaining information in relation to this explosion, he remarked that the rapid corrosion of the interior of iron boilers, might, in many cases, be attributed to the copper in the composition of the air pump, valves, feed pump, and pipes, &c. the water passing through them into the boiler having a *galvanic influence on the iron of the boiler*. In one case he observed that the part of an internal flue immediately opposite the mouth of a feeding pipe, and about four inches from it, was entirely eaten away, leaving a hole in the flue nine inches in diameter.

end of E is inserted the steam pipe S, it projects three inches, (or about half way,) through E, as represented. It is eleven inches in diameter. The horizontal flues, five in number, are twenty inches in diameter. The vertical flue forty-two inches. From its junction with the horizontal flues, (only one of which is seen in this figure,) to its upper end at D, D, is eleven feet. The water line at W, W, is about ten inches above the horizontal flues, and the remainder of C, being ten feet of its length, is always uncovered by water. The rent took place at R, from fifteen to twenty inches above the water line.

The line of fracture does not deviate more than six inches from a horizontal direction. It is partly along a row of rivets, but chiefly through the centre of the sheets. In one sheet the fracture exhibits the metal from one-fourth of an inch (its original thickness,) to one-eighth, and less than one-sixteenth.

The boiler is eighteen feet long, eleven feet wide, and six and a half feet deep, (see fig. 3,) its ends are flat. It is made of one-fourth inch wrought iron. Y, shows the form of the lower end of the collapsed flue; the circular part contained in dotted lines shows the original form of the flue, the irregular full lines show the form after the collapse. Fig. 4 represents it previous to its being taken out of the boiler; from the rent to the top of the collapse is six feet.



It will be perceived that the rent took place in that part of the main *flue* unprotected by water, and not in the steam chimney proper. This part of the flue is *always* exposed to the flame or heated air, and *never* covered by water.

Engineers consider it necessary to keep internal flues as well as those portions of the sides of boilers which are exposed to the fire, covered by water, as the only means of preventing them from rending; but in using steam chimneys, a method the *very reverse* is adopted. By them part of the flue above the water, is *necessarily* exposed, and this part embraces nearly *the whole* of the main internal flue, in which is accumulated all the heat and flame from the furnace that escapes through the horizontal flues.

In the Ohio, the part thus exposed is ten feet long and three and a

half feet diameter, the whole of which is always uncovered by water, except what may be occasionally thrown up against it by ebullition.

The circumstance of this flue being in a perpendicular position can impart no additional security from the action of the fire, but rather the contrary, since the whole of its circumference is exposed to its influence. The only difference in its favour is that the greatest portion of heat from the furnace is probably taken up by the bottom of the boiler and the horizontal flues before entering it; and this is the supposition of those who advocate the use of steam chimnies. The heat, they further say, is "*exhausted*" before entering the vertical flue, and that without regard to the nature of the fuel used.

But if the heat were *exhausted* before entering the vertical flue, the steam chimney would be useless, as its design is to impart the extra heat of the fire chimney to the steam.

This heat is, however, far from being exhausted. The working cylinders of the Ohio are nearly forty feet distant from the steam chimnies, consequently the steam pipes are about the same length; and yet the packing of the pistons, and the hempen covering of the steam pipes, have frequently been charred.

The temperature of that portion of the horizontal flues near to where they unite with the vertical one, will be much the same as the lower part of the latter. If there be any difference, the vertical flue is probably the hottest, because the heat from all the others is there received by it, and the direction of the draft is suddenly changed at the same place: hence, if part of the horizontal flues are in danger of collapse when uncovered by water, the lower part, at least, of the vertical flue is equally so, and from the same cause.

But the appearance of the ruptured flue is a sufficient proof that the heat is not exhausted before entering it. It is fairly burnt out. In some places not even one-sixth of its thickness is left. The greater part of this flue was new about eighteen months ago, but the part rent has been in use a little more than two years.

When it is considered that the part rent was constantly liable to be made *red hot*, and probably was frequently so, we need not wonder that it collapsed under a pressure of fifteen pounds to the square inch. The greater wonder is, that it withstood it so long.

The same cause also accounts for the rapid destruction of its material. Indeed these flues are all rapidly worn out at the same place, and this is the testimony of an experienced manufacturer of steam engines. It is corroborated also by that of an intelligent engineer, who informed me lately that one of our largest and most splendid boats, had a new vertical flue last season, and yet a portion of it had to be replaced near the water line a few weeks ago, being no longer safe.

There is another circumstance attending the use of steam chimnies which still further promotes the destruction of the flue in question, viz. the large quantity of mud and other matters that float on the water is drawn against this flue (where it hardens and forms a crust)

by the current of the steam in rushing up into the steam pipe at every stroke of the piston.

Fusible plates and valves have been designed to prevent the temperature of the steam from exceeding that of the water on which it reposes, but these devices are totally inapplicable to steam chimnies, since the very evil they are designed to prevent, is considered an advantage in the use of the latter.

The advantage of steam chimnies, it is said, is that "they rarify and still further expand the steam after it is generated;" but its expansive *force* cannot thereby be increased above that in the other parts of the boiler; for steam of different elastic power cannot exist in the same vessel at the same time. And whether they are of any advantage by depriving the steam of a portion of its moisture, previous to its entering the cylinder is at least doubtful, since it is one of its constituent principles, by depriving it of which, its density is proportionably diminished, and upon the density and temperature depend the expansive force of the steam.

The theoretical question of the effect of heating steam, after it is produced, in contact with the water which produced it, requires further elucidation. And after this should be determined we must consider the effect to be derived from transmitting this rarified steam through the pipes to the cylinder. But let us admit for steam chimnies all the advantages which have been claimed for them. Let us admit that their use economises heat which would otherwise be lost or less perfectly applied, and then let us answer the question, can these advantages make up for the increased dangers of explosions? can a paltry consideration of doubtful economy justify the exposure of human life incident to the use of a *heated flue uncovered by water?* The answer is plain, and the public are interested in making it heard.

THOS. EWBANK.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1832.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *Planing Boards, Cutting Tenons,* reducing marble, and other hard substances, and for grinding and polishing the same; Moses Lancaster, Northern Liberties, Philadelphia county, April 5.

(See specification.)

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2. For a machine for *Hulling Clover, Buckwheat and Bar-*

ley, and for scouring wheat; Thomas Register, West Township, Columbiana county, Ohio, April 5.

The specification informs us that in this machine there is a cylinder of free, or sand, stone, two feet in length, with an iron spindle through it turned by a crank; a concave of the same material, which is borne up against the cylinder, and a hopper for the grain or seed.

Not a word occurs respecting novelty, invention, or claim; we infer, therefore, from this, and from other circumstances, that there was no room to assert either.

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3. For a machine for *Cleaning Clover Seed;* George Faber, Chambersburg, Franklin county, Pennsylvania, April 5.

(See specification.)

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4. For an *Apple Grinding Machine;* Jonathan R. Dean, Augusta, Columbiana county, Ohio, April 5.

This is a very simple machine. A block of wood, formed like a grindstone, is to turn on an axis in the same manner; brads, or wires, are driven into it, standing out one-eighth of an inch, and a concave piece is to encompass one-third of this grinder, its lower edge standing close to the spikes; this concave is to be surmounted by a hopper, and there is to be a trough below to catch the pomace.

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5. For an improvement in *Doors, by which the common threshold is superseded;* Eastman R. Ball, Oswego, Oswego county, New York, April 5.

The lower rail of the door is grooved to receive a strip, or valve, which when the door is shut is protruded downwards, and when it is open passes up into the groove.

The strip is held, and acted upon, by an angled lever, which stands in a mortice within the rail, above the groove and strip. A rod which is let into the rail, from the back edge of the door, is forced out by a spiral spring, and this raises the strip when the door is opened. When it is shut, this rod comes in contact with the rebate of the door frame, which, forcing it in, acts upon the lever and depresses the strip.

Contrivances very similar to this have been before made and patented.

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6. For *Preparing Yarn and making it into Packing suitable to use about Steam Engines;* William V. Grinnels, Middletown, Middlesex county, Connecticut, April 5.

Yarn made of hemp is to be boiled in strong brine, and after allowing it to cool it is to be soaked for several days in ley, made of ashes and lime; after this it is to be dried, plaited, and worked up for use.

What good properties are communicated to the yarn by this process we are not informed; perhaps, however, it is intended to render

it as incombustible as Salamander's wool, that it may resist those high degrees of heat which destroy the packing in engines of extremely high pressure.

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7. For *Stocks for Gentlemen's wear;* Edmund Badger, city of Philadelphia, April 5.

(See specification.)

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8. For an improvement in the *Machine used for Pegging Shoes and Boots;* Frederick Gray, Rowley, Essex county, Massachusetts, April 6.

The machine here patented for pegging boots, consists of an improved apparatus for holding the last firmly during the operation; to explain this contrivance clearly, would require a drawing, and we think but few will feel interest enough in the subject to regret the want of this appendage.

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9. For *Seasoning Timber by means of Steam;* Abraham Plumb, Buffalo, Erie county, New York, April 6.

We are at a loss to imagine in what place the patentee can have lived that he should have arrived at manhood without hearing that the seasoning of timber by means of steam is a process well known and frequently practised. When we saw the title of the patent we concluded that some new apparatus, or mode of application, formed its basis; but we are simply told that the timber is to be put into a tight box, and to have steam from a boiler admitted to it through a pipe; and the claim is merely to "the application of steam to green lumber for the purpose of facilitating and hastening the seasoning, drying, and fitting it for use."

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10. For a *Washing Machine;* David G. Wilson, Machias, Washington county, Maine, April 6.

A trough with a semicircular bottom, has a shaft crossing it, and carrying within it what the patentee calls moveable divers, that is, vibrating frames, formed of slats, which, being moved by a handle, squeeze the clothes to be washed against the grooved ends of the trough. This being nothing more than a trifling variation from preceding machines, we do not think it necessary even to insert the claim of the patentee.

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11. For a *Spiral Flanched Shell, to be used as a substitute for the ordinary Bomb Shell, or Howitz;* William B. Pier and Andrew Mask, Detroit, Wayne county, Michigan Territory, April 6.

(See description among the specifications.)

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12. For a *Machine for making Axes;* Josiah Pratt, jr., Claremont, Franklin county, Massachusetts, April 6.

This machinery consists of what the patentee denominates hammer and anvil dies; the first kind are to be worked like a trip hammer, the last, as the name indicates, forming the anvil, or bed. A particular description of the curvature of the faces of these dies, and of their size, is given in the specification.

The foundation of the axe from the bar of iron, is laid with one pair of dies, and another set is used for finishing. There is no claim made; reliance being placed on the entire novelty of the whole plan. "The manner of holding the iron under the dies, and the skill of moulding the axe," we are told, can be learnt only by observation and practice."

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13. For an improvement in the *Striking part of Clocks;* George Parker, Utica, Oneida county, New York, April 7.

Without a more lengthened description than, in our opinion, the alleged improvement calls for, we cannot make known the particulars in which the arrangement of the striking part, as described by the patentee, differs from that of the common clock; the object, we presume, is to construct it with somewhat less labour than that usually required, but the mode of accomplishing this is not clearly made known by the description and drawing.

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14. For an improvement in *Coaches, Barouches, and all kinds of Carriages;* Robert Gedney, city of New York, April 7.

The improvement described and claimed, consists in forming a moveable top, or cover, by which a barouche, or other open carriage, may, when desired, be converted into a close one.

The top may be made of wood, metal, leather, or any other suitable substance, and consists of two parts, each of which is a quadrant of a cylinder, working upon joints, or pins, in the centres of their curvature, on the side of the carriage. The body of the carriage must be made double, to form a cavity into which the covers which form the close top may fall; these cavities and tops are made much in the way with those of some circular fall writing desks. There are circular segments, or ratchets, to hold the tops in any required position; and in the ends, or peripheries, of the moveable tops, windows or blinds may be placed. The claim is to the "method of forming a moveable cover to barouches, and carriages of all kinds, by means of moveable segment covers turning on pivots, and shutting, or folding, within each other, so as to form an open, partly closed, or wholly closed, carriage."

If there is no objection to the perfectly circular, or cylindrical form which must be given to the body of the carriage, we do not know of any other that can be urged against this plan; we, however, are apprehensive that this form will not suit the large hats of the ladies, or admit of the desired perpendicular attitude in gentlemen above the middle stature.

15. For an improvement in the *Gun Lock;* Francis Dowler, Wayne, Knox county, Ohio, April 9.

The difference between this and the ordinary percussion lock consists in attaching to the usual lock plate nothing but the hammer lever by which the powder is to be exploded. The lever which acts upon the tail of the hammer, the main spring which bears against it, and all the other apparatus of the lock, are attached to the trigger plate, and are modified in their form accordingly. There is no claim made, nor do we perceive the slightest advantage to be derived from this particular construction.

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16. For machinery for *Jointing Staves* by means of a circular saw, and for *Sawing Bulging Staves* by means of a concave-convex circular saw; Philip Cornell, Brutus, Cayuga county, New York, April 11.

(See description among the specifications.)

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17. For a *Washing Machine;* Simeon Savage, East Machias, Washington county, Maine, April 11.

The washing in this machine is to be effected by passing the clothes between two wooden rollers, placed side by side across a trough, one of them being allowed to recede from the other whilst it is borne up against it by means of a weighted lever. In the operation of washing, a crank, attached to the gudgeon of one of the rollers, is turned with one hand, whilst with the other the clothes to be washed are conducted between the rollers; a sufficient quantity of soap suds being always kept in the trough.

The claim is to "the general arrangement of the machine herein described; that is, a machine with two horizontal rollers, one of which is borne against the other in the manner set forth."

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18. For machinery for *Cutting and Manufacturing Wooden Boxes;* Harrison Holland, Belchertown, Hampshire county, Massachusetts, April 13.

Wooden boxes are of so many kinds that the above title must fail in furnishing any definite idea of the intention of the machinery, nor does the petition, or the specification, supply the required information; we collect, however, from the drawing and the general description of the apparatus, that the boxes are to be round, and made out of solid stuff. An auger, running in the mandril of a lathe, is used to bore the boxes out, whilst cutters, placed at a proper distance from the auger, form the outside. A sliding carriage in front holds the timber, and this is brought up by proper contrivances against the auger and cutters. A circular saw, upon a sliding carriage, is used to cut the box off. The lids, it is said, may be formed on the same principle, but in this case the auger is to be shortened in due proportion. At the end of the specification we are told that "green timber will answer as well as that which is seasoned. This information is not calculated to throw much light upon the purposes for

which the said boxes are to be made, as they will soon lose their rotundity if made of unseasoned stuff.

There is no claim made to the machinery as a whole, or in part, excepting that in speaking of the auger with which the boring is to be effected, it is said that it is "a screw auger, *without a centre;* this is claimed as a new invention, and may be applied to other uses." The fact is, that the screw auger, without a centre, has been applied to other uses long since, and therefore it is not new. We have in our possession one of this description, which was patented so long since that the patent has run out.

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19. For an improved *Steam Valve,* called the "Face Plate Valve;" Stacy Costil, Philadelphia county, Pennsylvania, April 13.

The specification before us describes no particular construction of valve, but would apply perfectly well to a large proportion of those in general use. The patentee gives us no further information than that the valve consists of two plates with cavities, that it is made of iron or other metal, fitted so as to prevent the escape of fluids, except through the cavities, when they come opposite to each other; that there may be one or more cavities for the passage of the fluids; that the valve by a rotary motion may be used as a pump; (?) that the plates may be held together by a screw, or otherwise; that when the plates are in such a position that the cavities are not opposite to each other, the fluids are confined; and that the valve can be applied to cocks, &c.

The foregoing contains the whole sum and substance of the specification, and those who know any thing upon the subject will perceive that it would embrace in its generalizations, the various kinds of sliding valve, the old rotary valve of Oliver Evans, and a great number of others. What the patentee intended to patent, and thinks he has patented, we cannot divine.

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20. For a *Washing Machine;* Silvanus Minton, Anderson District, South Carolina, April 14.

This washing machine resembles the old fashioned cider mill, in the construction of the rollers which are to effect the washing. Two fluted rollers, each ten inches in diameter, are placed one over the other, with a suitable trough beneath them. The flutes, or teeth, mashing in like those of a cog wheel. The upper roller is borne down by weights, allowing it to recede from the lower one.

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21. For *Apparatus to reduce the Friction in Axletrees;* Francis Reese, Habersham county, Georgia, April 14.

This apparatus to reduce friction consists of two rollers placed one behind the other on the lower side of each axle; they are to be

three inches long, and one and a half inches in diameter, are to be let into mortices, and to revolve upon suitable gudgeons, their peripheries bearing within the boxes. The same thing, exactly, has been done before, and there is, therefore, no novelty in the contrivance; but a still less fortunate circumstance than this, is its entire want of utility. The gudgeons of the rollers are not adapted to bear the heavy weight which they have to sustain, and soon wear out. The rollers must bear against iron or steel within the hubs, or they immediately make a groove; the jolts to which they are subjected soon convert the rollers into polygons, and they cease to turn; besides all this, and much more, the weight cannot be made to rest on the rollers, were they calculated to sustain it, as the draft of the wagon will always cause the side of the axle to bear against the hub.

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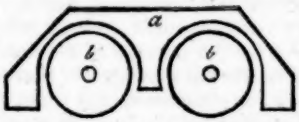
22. For a *Ruler for Counting Houses, &c.;* James Carrington, Wallingford, New Haven county, Connecticut, April 14.

This is intended as a substitute for the common round ruler, to which it is certainly much superior. It consists of a piece of mahogany, or other wood, made in the form shown at *a*, which is a transverse section of it. There are two grooves along the under side of it, to receive the two parallel rollers *o, b*, which extend its whole length, and revolve on pins running in metal plates at each end of the ruler.



The tendency of this ruler is always to run parallel; it does not readily slip like the common ruler; the bearing of the pen or plummet, is near to the paper, whilst the rollers keep the ruler sufficiently elevated to prevent all danger of blotting.

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23. For a *Churn*, called the revolving Dasher Churn; Hardin Branch, city of New York, April 18.

Within a box, the bottom of which is made concave, there are revolving dashers, turned by a crank upon one of the gudgeons which passes through the end of the box.

The claim is to the before described churn.

We are of opinion that any one who will either make, or purchase such a churn from the patentee, or from any other person, may, with equal propriety, lay claim to the before described churn, without the necessity of placing the fact upon record in the patent office.

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24. For a *Thrashing Machine;* Hardin Branch, city of New York, April 18.

The beaters of this thrashing machine are hinged to the cylinder, as has been repeatedly done. There is a hopper, or inclined plane, feeding rollers, a concave of bars, whirls, bands, &c., all of which are noticed in the description; after which a claim is made to "the

before described machine." The concluding remark relating to the last noticed patent, will apply equally well in the present case.

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25. For *Fastenings for Bedsteads;* Hardin Branch, city of New York, April 18.

A piece of cast iron, or other metal, is affixed to the end of the rail, and a corresponding piece on the post; the latter is in the form of a dovetailed wedge, and the former has a cavity within which it fits. The rail fastens on to the post by letting it drop down so that the cavities pass on to the wedge. One of the earliest of the various contrivances for dispensing with screws in fastening bedsteads, was of this character. In the present instance, however, the mode of attaching the fastenings to the rails and post is more simple, and proportionately less secure; this is the only *improvement* which we can discover in the thing. The claim is to "the before described method of fastening the posts and rails of bedsteads together by the dovetailed mortise and wedge, or tongue."

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26. For a *Machine for Thrashing and Grinding Grain;* Matthew Wilson, Springfield, Rockbridge county, Virginia, April 18.

This is said to be an improvement in Samuel Cochran's wheat thrashing machine; but judging by the improvement alone, we apprehend that there are many other persons who may lay claim to the original. The claim to improvement is, in the first place, the gearing the horse power, by which the thrashing machine is to be driven so as to give it a quicker motion than ordinary. Secondly, the manner of applying a band from a drum around a pulley; this consists in giving the band two turns and crossing it, which the patentee says is "altogether new." The cast heads of the cylinder upon which the planking and beaters are fixed, and the secure method of putting them on are also claimed. By the same horse power which performs the thrashing, a small grist mill is to be driven; and the mode of gearing and manner of working this, form another claim.

If the claim to gearing so as to give greater speed than ordinary, is one which can be sustained, every additional cog added to a driving wheel, and every leaf subtracted from a pinion, may be the subject of a patent. We should demur to the novelty of crossing a band, and passing it twice round a whirl, and indeed to most of the points upon which the patentee has rested his right as an original inventor.

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27. For *Door Fasteners;* Calvin Washburn, Bridgewater, Plymouth county, Massachusetts, April 18.

This is a spring door catch, operated on by handles in the usual way, but with some peculiarity in the arrangement of the parts which may be called new, and upon which the claim rests. We are not aware, however, that it is superior to some others, and shall there-

fore dismiss it, as, without a drawing, its peculiarity could not be easily described.

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28. For an improvement in the *Mode of drawing Soda and other Mineral Waters;* George H. Duffey, Alexandria, Alexandria county, Virginia, April 19.

We have given an account of five different patents, each having the same object in view with the present; that is, to draw off by one cock the liquor from two separate vessels, one of which contains an acid solution, and the other a solution of carbonate of soda. The patentee in the present case says that this invention "consists in making the divisions and openings in the tube of the key so that liquids may be conveyed down each division separately, and not unite till they meet in the glass or vessel for receiving them, whereas the method lately patented, and now in use for drawing soda water by means of a compound cock, is to suffer the two liquors to unite in the cock, whereby the stronger liquor is forced up the tube of the weaker, and the whole spoiled."

We are not certain, and do not think it necessary to ascertain, whether in all the five patents previously obtained, the mixture of the liquids takes place before it actually leaves the cock, or not, although we believe this to be the case, but we do not believe that the evil above stated, namely, that the stronger liquor is forced up the tube, &c., necessarily, or generally, exists—by the by, which is the stronger and which the weaker liquor of the two named, we really do not know—where, from the height of the fluids, there is a moderate pressure, this pressure combined with the ready exit which they find from the cock, would prevent such an effect. Some of the former patentees claim the drawing off of two fluids by one cock, and either this claim is worthless, or the present interferes with it.

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29. For a *Churn*, called the "balance lever churn;" Caleb Argevine, city of New York, April 19.

This churn is two churns, each of which has its dasher and staff. A lever is made to vibrate like a scale beam, and has a dasher staff attached to each of its ends, the churns being firmly fixed on a platform beneath them. A band wheel, turned by a winch, gives motion to a whirl, on the shaft of which there is a crank, and a pitman from this crank causes the lever to vibrate. What the patentee "particularly" claims "is the equalizing power and combined advantages of the driving wheel, fly wheel, crank, and horizontal pitman, in giving motion to two churns in one operation."

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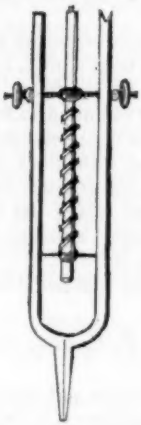
30. For a *Centre Point Spring Bit;* Daniel Flint, Nobleborough, Lincoln county, Maine, April 19.

This bit may be likened, in form, to a tuning fork, the handle of which would represent the shank, and the forked ends the cutting



points. One of these points is notched, so as to cut a double groove, and the opposite point is chisel shaped, to cut out the stuff between the two grooves. The bit may be fixed in a lathe, or stock. To gauge it to the exact size required, a thumb screw passes through the two forks, and by means of this the points may be drawn together. The inside edges of the cutting ends may be so formed as to give a taper, or beviled entering to the plug which is to be cut out by it. There is also a centre piece, which being borne up by a spiral spring, recedes as the points advance.

The principal intention of the bit is to manufacture plugs for ships, although it is applicable to other purposes, such as making bungs for barrels, &c.

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31. For a *Cutting Box for Straw, Stalks, &c.;* Jacob Harland, Tompkinsville, Monroe county, Kentucky, April 19.

A winch, which is to be turned by hand, has on its shaft a fly wheel and crank. The crank gives motion to the cutting knife, which is fixed in a frame, working up and down at the front end of the box, like a saw frame. The feeding is effected by a rack, and the parts, generally, operate upon the same principle with a number of other straw cutters. There are certain claims made, but they refer to trivial points, and not to any thing essential to such a machine.

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32. For apparatus or machinery for *Holding and Guiding Edge Tools in the operation of Grinding;* George A. Madeira, Chambersburg, Franklin county, Pennsylvania, April 19.

(See specification.)

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33. For *Protecting Bank Notes, &c.* from being counterfeited; Francis Peabody, and Joseph Dixon, Salem, Essex county, Massachusetts, April 20.

The object had in view by the patentees is to prevent the counterfeiting of bank notes by means of lithography. Those acquainted with that art are aware that the impression upon a bank note, or other engraving, printed with ink into which oil enters as a component part, may be transferred on to stone, and the stone then used to furnish similar impressions on paper. According to recent accounts from Europe the utmost perfection has been attained in this process, which, as it is merely mechanical, may enable one who is no artist

to imitate the work of the best engravers in a way which shall defy detection.

The means by which the patentees effect their object is by taking printers' ink, or ink made from oil, which is to be of a pink, light blue, or other tint, and which will serve as a ground for the black ink generally used in printing bank notes. The paper intended to be printed on is first covered wholly, or in part, with the light coloured oleagenous ink, and after this the notes are printed with black ink in the usual way. Any attempt to make a lithographic transfer from paper so prepared must fail altogether, as every part which has either the tinted or the black ink on it, will affect the stone, and only a confused, blurred impression, can be obtained from it.

The claim is to the preparing of paper in the manner described.

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34. For a *Washing Machine;* Benton P. Coston, city of Philadelphia, April 27.

The soap suds and the clothes to be washed are put into a suitable trough, and within this trough is a fluted washboard; a fluted roller, borne down by springs, is made to vibrate over the board by proper contrivances, of which we have as little inclination to give a description, as most of our subscribers would have to read it if given.

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35. For an *Engine for Turning Whip Sticks,* or Handles; Andrew Mallory, Russel, Hampden county, Massachusetts, April 27.

This engine is intended to be used in turning whip handles tapering, either regularly or otherwise, and it may also be employed for helves, or other sticks, whether cylindrical or tapering. The stick to be turned may be fixed in the mandril of a common turning lathe, and the apparatus here patented placed in front of it. It consists, in part, of a frame with parallel sides, equal in length to the length of the stick to be turned. A piece carrying a cutter, which operates as a gouge and chisel, slides along in grooves on these sides. This sliding part consists of two bars hinged together at one end, and capable of being opened or closed at the other; and near to this latter end is fixed the cutter before spoken of. The stick to be turned rests on a hollow bearing of metal on the lower piece, and the cutter passes through the upper piece. It is evident that if these two parts, which form the hinged sliding bar, recede from each other as the bar advances, the article operated upon by the cutter will have a corresponding increase in its diameter. To effect this, each of the bars has a tongue on it which slides in a groove on one of the cheeks of the frame. There are, of course, two grooves, and if these were parallel to each other, the two parts of the sliding bar would keep at the same distance apart, and the article turned would be cylindrical; but if the grooves recede, the bars will be gradually separated, and the article will be tapered.

The whole machine is claimed as new, and not as an improvement on any other for the same purpose previously known.

36. For an improvement in the *Plough;* John B. Norton, Utica, Oneida county, New York, April 27.

This is to be a self-sharpening plough, and the description amounts, altogether, to but five lines. The improvement is said to consist in a recess on the back of the mould board, and a projection on the flanch to fill this recess, which is to be sufficiently wide to prevent the flanch from tipping, or changing its position on the mould board; it is intended, likewise, to prevent the flanch from shifting when the pattern is being moulded. The foregoing description is somewhat obscure; we have the drawing before us, but there is in this also so much taken for granted, that we have not sufficient imagination to fill up the chasms, and may in consequence, suffer great loss.

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37. For *Obtaining Opium from the Poppy,* by expression; Lucius Cook, Shrewsbury, Monmouth county, New Jersey, April 27.

We have here a specification still more brief than the last, being merely informed in it that opium is to be expressed from the poppy by a press of any kind; a screw press, like that of an oil mill, being preferred.

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38. For *Applying Copal or other Varnish* to Whip stocks, or other articles, by dipping; Frederick Morgan, Westfield, Hampden county, Massachusetts, April 27.

The articles to be operated on are to be dipped into a tube filled with the varnish, which, it is said, is a superior method to the use of a brush. This is the whole recipe, and we are very apprehensive that there are but few persons in the habit of using varnish who have not occasionally resorted to the same mode; we have repeatedly done it, although not with whip stocks, and we may probably do it again, with "other articles," the patent before us to the contrary notwithstanding.

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39. For a *Floating Screw Dock;* Stephen F. Stinchfield, New Orleans, Louisiana, April 27.

The floats which in this contrivance are to answer the purpose of wharves in the ordinary screw dock, are formed by two boats, or flats, securely framed and planked. Screws, with their proper nuts, are sustained upon these floats, and are of sufficient length to reach down to the cradle beams over which the vessel is to be floated, and upon which there are the necessary keel blocks, bilge blocks, and other appurtenances. The claim is to "the before described floating screw dock, for raising vessels, or for floating them over sand bars, or when run aground."

The screw dock has been previously patented, and is extensively used; and as it is intended to employ this floating dock for the purpose of repairing vessels, we apprehend that the claim of the patentee will not be available, for although he uses floats instead of

wharves upon which to sustain his screws, these still operate in the same way with those alluded to.

We are at a loss to perceive how, on the plan we are now considering, the cradle beams are to be passed under a vessel which is aground; there may possibly be instances in which this can be done, but we think they must be very rare.

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40. For a machine to *Prepare Card Boards* to receive the handle and the card; Homer Whittemore, Newtown, Queen's county, New York, April 27.

The card board is to have two dovetailing kerfs sawed into it by means of a circular saw, in the usual manner. It is then placed upon a machine which holds it firmly, and a chisel, fixed in a sliding frame, is brought up by a crank, and cuts out the chip, which there is also a contrivance to remove. The handle is then driven in to its place, and the projecting part of it planed off by revolving planes, attached to the mandril of a turning lathe.

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41. For a *Lever Power Machine for Propelling Mills*, and which may be applied to boats, water craft, rail-road carriages, &c.; William Rhodes, Trenton, Gibson county, Tennessee, April 27.

This is another of those miserable schemes for gaining power which can deceive those only who are totally ignorant of the principles of mechanics, a class, however, which, unfortunately, appears in every community to be a very large one.

A crank placed on the end of a vertical shaft is to be turned by horse, or other power; at the lower end of this shaft is a large horizontal crown wheel, the teeth of which drive a wallower; and from the shaft of the wallower rises a pitman, which alternately elevates and depresses two long levers of the second kind. Palls, or catches, descend from these levers, and engage into ratchet wheels on a horizontal shaft, there being two such wheels, one for the catch of each lever. The levers, as they rise, drag round the shaft of the ratchet wheels, and from this, the power, *created* by the described arrangement, is to be communicated and employed for any required purpose.

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42. For a *Rotary Toggle Joint Press;* Thomas W. Harvey, Jamestown, Chautauqua county, New York, April 27.

Without a drawing we shall not attempt a description of this press, particularly as we expect, at an early day, to publish the specification, with an engraving. We will merely observe that what is usually called the toggle joint is not employed in it, the two levers which operate upon this principle not being connected together, although they are brought into contact with each other by the revolution of two parallel shafts from which they project. The machine is about being put into operation in New York, and should it answer the anticipated purpose, it may be applied to the cutting of various

articles; to stamping impressions from dies, and for a great variety of other objects.

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43. For a machine for *Planing, Tonguing, and Grooving Boards;* John Drummond, Whitestown, Oneida county, New York, April 27.

Two pulleys, of about eighteen inches in diameter, and which run vertically, are placed at such distance from each other as shall correspond with the length of the stuff to be planed. Planes are attached to a strap, or band, which passes round these pulleys, and the plane stocks are supported by ways, on which pins, or a tongue, projecting from it, bear, as the straps and planes revolve. The board to be planed is placed upon a horizontal bed, or bench, so situated that the faces of the planes shall pass over it. The planes, as they pass round, strike against a spring catch intended to shift the board under them, laterally, at every stroke.

The claim is to "the before described machine for planing boards; particularly the way, with semicircular ends, the belt and pulleys by which the plane, or planes, are moved and governed; and the moveable parts for giving proper thickness to the boards."

We are of opinion that this machine has never been tried in practice, as we believe that after doing so the inventor would have declined taking a patent for it; the objections to it appear to us to be numerous and insuperable.

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44. For a *Wind and Water Wheel;* Adkins Nash, Addison, Washington county, Maine, April 27.

This is a wheel with wings, or buckets, hinged, or suspended by pins, upon which they turn, in order to their being presented edgewise, or flatwise, to the fluid which is to act upon them.

The floats, or wings, are to be made concave on one side and convex on the other; the wheel, when used for wind, is to be placed vertically, and a very complex apparatus of ropes and blocks is employed to give to the wings, or sails, a proper direction; four pulleys being used to each wing. There is an endless screw and a cog wheel employed to turn a barrel, over which pass numerous ropes that are reeved through the pulley blocks in a way which we do not think it worth while to describe. When operated upon by water the floats are to regulate themselves.

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45. For a *Process for Flattening Window Glass;* John J. Adams, city of Washington, District of Columbia, April 27.

The apparatus here patented is intended for flattening cylinder window glass. It consists of a circular oven, or flattening furnace, having in it a circular rail-way of cast iron, upon which the flattening apparatus can be made to revolve. The cylinder is to be put in through the stick hole, and, as it is acted upon by the fuel, is carried round until it arrives opposite to one of the flattening mouths, where it is flattened out upon a stone in the usual manner. By further

turning, it is carried round until it arrives at what is called the cooling arch. This is an arch of about thirty feet in length, and three in width; within it two endless chains pass over rollers which cross it at suitable distances, for sustaining the chains. Upon these chains are keyed plates of sheet iron, about three by two and a half feet, upon one of which the flattened plate is laid from the flattening apparatus; the endless chain is then carried forward by turning a winch until another sheet of iron presents itself to receive another plate of glass; the plates are thus gradually carried along the cooling arch, until they are ready to be delivered from the far end.

The plan of the cooling arch is similar to that of the annealing ovens at the flint glass works, and would undoubtedly answer the intended purpose; we have not equal confidence in the annealing furnace, and the apparatus within it. Without the aid of actual experiment it is not possible to say that the fire can be so managed as to afford the exact degree of heat which is requisite, or that the revolving rail-way would not be attended by unanticipated difficulties in the course of its operation.

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46. For an improvement in the *Grist Mill;* Amos Barnes, Colesville, Broom county, New York, April 27.

It is said that by this improvement the power required for driving the mill is lessened, the motion of the stone regulated, the friction reduced, and even grinding promoted. The stones are to be about two feet in diameter, and the upper one, the runner, is to be covered with a casing of cast iron, in order to give it weight; the eye of the stone is to be wider on the lower than on the upper side, and above the drum, or pulley, there is to be a balance wheel by which the mill is to be driven; there are to be several other contrivances which, however, are so similar to what we have had repeated occasions to describe, that we omit further notice of them. A number of things are claimed, some of which, as that of weighting the stone, the form of the eye, &c. &c. are old; if, however, the mill performs better than any other, as the patentee says it does, that at least will be something new.

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47. For a *Reaction Water Wheel for Mills;* John Moffit, Richmond, Ross county, Ohio, April 27.

This is very much like the common tub wheel, but there are some provisions made respecting its structure which we do not fully understand.

The wheel, we are told, is to be made of eight solid blocks, and is to run horizontally upon the lower end of a shaft, which is to be a hollow cylinder in order to prevent the too great weight of water upon the wheel. This cylinder is to be surrounded by another, and between these the water is to descend to the openings which surround, and are near to, the periphery of the wheel. There are to be eight of these perforations passing obliquely from the upper to the lower surface, at an angle of forty-five degrees. The improvements principally relied on, are the delivery of the water at the bottom in-

stead of the side of the wheel, and the double cylinder for its descent.

We perceive no advantage, whilst there is a real disadvantage in delivering the water at the bottom, instead of at the sides; the point of delivery of a large portion of the water must be considerably nearer to the centre of motion on the former, than on the latter plan; and besides this, the delivery at the bottom is not itself new.

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48. For a *Machine for Spinning Wool and Cotton;* David Newbrough, Riley Township, Butler county, Ohio, April 27.

A spinning wheel, instead of turning one only, gives motion to six, or more, spindles, by suitable bands. The carded rolls are placed in troughs or gutters opposite to the spindles, and there are the requisite contrivances for winding the yarn upon the spindles after it has been spun. There, however, is nothing worth a particular description, as the whole apparatus is similar to a number of other domestic spinners patented a few years since, but which have gone out of fashion since the extensive introduction of machinery into our manufactories.

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49. For a machine for *Hulling Clover Seed;* George Monohon, Augusta, Columbiana county, Ohio, April 27.

A trough is made which is to be eight feet long, two feet wide, and one foot high. The bottom of this trough is concave lengthwise, to a radius of twenty feet, and is fluted across in flutes of half an inch wide. Within this, is fitted a convex rubber which may be about half the length of the trough, and is furnished with handles, for the purpose of working it backward and forward.

After describing this contrivance, the patentee adds that he also claims the right to any machine made of wood in the form of mill stones, whether placed horizontally or perpendicularly, enclosed within a hoop, or otherwise, guttered, or reeded, and whether moved by horse, or man, power. The description of the actual machine did not certainly prepare us for such a claim to machinery which bears scarcely any analogy with it; and which indeed seems to us to be a little like claiming all rubbing machines, past, present, and to come.

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50. For an improvement in the *Saw Mill;* John R. Drake, Owego, Tioga county, New York, April 27.

The saw frame and fender-posts of this machine, are constructed in the usual way, the main difference in it being in the form of the teeth of the saw. In a saw of six, or six and a half feet in length, there are to be about twenty teeth, the cutting points of which are to project downwards like a "duck's bill chisel." The form intended will be seen by the sketch in the margin. Guide pieces are to be fastened

to the fender posts, through notches in which the saw is to work, and it is thus to receive a lateral support; the claim is to the peculiar form of the teeth, and to the guides.

The latter have been frequently used, and the former, we apprehend, will not often be adopted. For most kinds of timber, the cutting such teeth, will be too rank; but, independently of this, a saw so formed will last but little time, as, in the process of sharpening, the teeth will not merely retire back, but will actually disappear. Teeth made in the usual manner can be so sharpened as to cut upon the proposed "duck's bill" principle, by merely filing them hooking underneath, and taking off the point nearly straight, on the front edge of the saw.

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51. For an improvement in the *Turning Lathe;* William Green, Bedford county, Tennessee, April 27.

The inventor says that this lathe has a carriage moved by iron cogs, to work the gouges, and an oblique and nipped bit for smoothing and centring cylinders; the gouges, &c. being tempered by screws.

Whatever merit may be attributed to this lathe in the part of the country where the patentee resides, he would, in other parts of the Union, find it to be a very rude kind of instrument. He may have invented the whole as described by him, but, were he well acquainted with the lathes now in use, he would acknowledge his own to be a very indifferent make-shift.

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52. For apparatus for *Preventing Chimneys from Smoking;* Jeremiah Sullivan, Washington city, District of Columbia, April 27.

Jambs, a top plate and back, are to be made much in the usual form of the Franklin stoves; the upper section of the back plate is hinged, so that it may be opened, or closed, at pleasure, to alter the size of the throat. In addition to this, there are to be sliding dampers to draw out and regulate the draft in the flue. In these consist the alleged *invention*, although such contrivances are well known and extensively used. We have had repeated occasions for making similar remarks, the latest will be found at p. 163, where it will be seen that a similar apparatus was patented on the 17th of March last.

There is not any thing said in the form of a claim, and, of course, the whole arrangement described is viewed by the patentee as new.

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53. For a *Cotton Press*; David Philips, Natchez, Mississippi, April 27.

There is some novelty in the construction of this press, more, in fact, than is exhibited by a majority of those patented for the same purpose. The packing is effected by means of a screw which is placed vertically, operating upon followers in a box placed horizon-

tally, and the machine may be so constructed as to pack two bales at once.

Two strong beams, thirty-four feet in length, and two feet in width, are to be laid horizontally; these are connected together by end pieces framed into them, which end pieces are equal in length to that of the bale to be formed. This frame, when enclosed below and above with proper doors, forms the boxes into which the cotton is to be forced by the followers. From the middle of this frame rise two vertical cheeks between which the screw is sustained; this screw may be twelve or fourteen feet in length, and extends down below the horizontal box where the power is applied to turn it. The nut through which it passes slides between the cheeks, and is raised and lowered by turning the screw, which does not itself ascend or descend, but merely moves the nut. Now we will suppose the nut raised between the cheeks to the upper part of the screw, and the followers to be withdrawn from the horizontal boxes in which the cotton is to be packed; in this state of things the doors are to be opened, the boxes filled with cotton, and the doors then closed, when the operation of pressing commences. In order to cause the nut, as it is drawn down, to act upon the follower, strong pieces of timber are hinged to it by one end, and by the other to the followers; and when the nut is up, these timbers may stand at an angle of forty-five degrees with the frame; as they are drawn down they approach towards a horizontal position, and when completely down are actually horizontal. The two acting together operate like the toggle joint which is straightened by the screw, thus forcing in the followers upon the cotton.

The usual provision is, of course, made in the boxes to receive the bagging and ropes for baling the cotton, which needs no explanation as it is common to cotton presses of every description.

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54. For *Making Barrels, and other vessels, so tight as to hold Oil* of various descriptions; Barnabas Springer, Henry county, Indiana, April 27.

After the barrel, or other vessel, has been put together, the hoops are to be loosened, and the joints allowed to open, when glue is to be passed into all the joints, and the hoops tightened. The joints in the heads are to be previously secured in the same way. Would not gum water, or other mucilage, answer equally well, and be more easily managed?

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55. For a machine for *Moulding and Pressing Bricks;* Daniel Bomford, Deerfield, Oneida county, New York, April 28.

Of this machine there is a long description given, which ends by claiming "the before described machine for moulding and pressing bricks;" the said machine, however, is very obscurely described as relates to some of its important working parts; and although we doubt not that, in point of arrangement, it presents sufficient novelty, there

is but little of it in its individual parts, or in the mode of its operation.

The clay, after being properly prepared, is put into a hopper, under which there is a carriage running horizontally, it being moved by means of a rack and pinion; the moulds are to be placed upon this carriage, and run under the hoppers; a presser, or follower, within the hopper, is then brought down, which carries a portion of the clay before it into the moulds; after this the moulds are run out, and the operation repeated.

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56. For *Preparing Luminous Glasses to be used in Orreries, Planetariums, &c.;* Morris J. Gardner, York, York county, Pennsylvania, April 30.

Globular, or other glasses, which are to represent planets or satellites, are to have a sufficient portion of phosphoric oil poured into them to moisten their inner surfaces. A small opening is to be left for a supply of air to excite the luminous appearance; this constitutes the whole invention, which is one of those that will, probably, not be carried into operation by any one except the inventor himself; at all events we are fully convinced that he will not make a fortune by his discovery. We could suggest what we deem much better modes of accomplishing the end proposed, but are apprehensive that even they would rarely, if ever, be essayed, and we are no admirers of abortions.

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57. For a mode of *Bleaching Yellow Wax;* John N. Shultze, chemist, city of New York, April 30.

(See description.)

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for machinery for Planing Boards, Dressing Marble, and other substances, and for Sawing Tenons. Granted to MOSES LANCASTER, *city of Philadelphia, April 5,* 1832.

To all whom it may concern, be it known, that I, Moses Lancaster, of the Northern Liberties, in the county of Philadelphia, have invented an improved machine, which may be used for planing boards, and reducing marble, and other kinds of stone, metallic, and other substances, to a flat surface; and in which circular saws are also employed for the slitting of tenons, and other purposes, and that the following is a full and exact description thereof.

For the planing of boards I construct a wheel which is made to revolve vertically upon a horizontal shaft by any suitable power. Or instead of a wheel, two, four, or any other number of arms may project from said shaft, and carry such irons, cutters, grinders, and polishers, as are intended to be fixed upon the wheel. The diameter of the wheel must be more than double the width of the article to be

cut, planed, ground or polished. Cutters, made in the manner of plane irons, are employed for planing, their cutting edges being on one face of the wheel, and they being set and secured in their places by wedges, or otherwise.

I do not, in general, make the face of the wheel where the cutters operate, of a continued flat surface, but near to its periphery I turn it down, or otherwise reduce it so that it shall form two, three, or more parallel planes, each one-fourth of an inch, more or less, below the other. Each of these faces may be furnished with cutters; that nearest the rim taking the place of the ordinary jack plane, and the others in succession further reducing and smoothing the substance.

When stone, or other hard material, is to be cut, the cutters must be so formed as to adapt them to the intended purpose. When substances are to be ground, or polished, pieces of grinding or of polishing stone, or other suitable materials, occupy the place of the cutters upon the face of the wheel.

A carriage, or sliding frame, is made to run in grooves, near to the face of the wheel, and to pass above its axle, the frame work of the machinery being so constructed as to sustain and guide said carriage horizontally; it must be of such length and width as to receive the board, or other article to be operated upon by the wheel. Against this, such article is to be placed, its edge resting on proper ledges or supports, and the whole being held against the carriage by clamps, screws, or other contrivances.

The wheel is made adjustible on its gudgeons, so that it may adapt itself to the thickness of the article to be cut or ground.

For cutting tenons, I fix two or more circular saws upon the same shaft, regulating their distance from each other by disks of wood or of metal placed between them. The shaft carrying these saws is placed horizontally in the same frame with, and parallel to, that carrying the cutter wheel. The rails, or other stuff upon which tenons are to be sawed, are to be secured upon the sliding carriage before mentioned, with the end to be cut downwards, so that when the carriage is forced forward the revolving saws shall cut into it the proper depth for the tenon.

The saw shaft may be shifted endwise, like that of the cutter wheel, to adapt it to its purpose.

What I claim as my invention is the vertical wheel, constructed in the manner described, with cutters upon successive faces, retiring from each other, or with grinders or polishers applied in the manner and for the purposes hereinbefore set forth, and also the employment of circular saws for cutting tenons, operating in the way described in the foregoing specification.

MOSES LANCASTER.

Specification of a patent for a Machine for Cleaning Clover Seed. Granted to GEORGE FABER, *Chambersburg, Franklin county, Pennsylvania, April 5*, 1832.

To all whom it may concern, be it known, that I, George Faber, of Chambersburgh, in the state of Pennsylvania, have invented an improvement in the machine employed for the cleaning of clover seed, and that the following is a full and exact description thereof.

In my machine, the clover to be cleaned is made to pass between cylinders and concaves, as in many others constructed for a similar purpose; but my cylinders and concaves are set with teeth in a manner altogether different from that of such as have been heretofore made. I prepare wire cards by setting card teeth in leather in the usual manner, but of coarser wire, and with the rows between the teeth wider than ordinary. The wire, for example, may be about No. 17 or 18, and it is to be so set as to leave clear parallel spaces between the rows of teeth, which spaces may be an eighth of an inch or more in width. These cards are to be fixed upon the cylinders, with the teeth and spaces forming lines passing directly around, and parallel with their ends; and also in the hollow of the concaves in the same way.

When the cylinder and concave are fixed in the frame within which the former is to revolve, the teeth of the cylinder pass in the spaces between those on the concave; the two being placed so near to each other that the points of the revolving teeth come nearly in contact with the leather on the concave, and the teeth on the concave nearly touch the leather on the cylinder, whilst the teeth themselves run clear of each other, that is, those on the cylinder do not touch those on the concave.

The cylinder is made to revolve in such way that the teeth on it and those on the concave have no tendency to catch, their points being inclined in a direction opposite to that of the revolution.

I generally make the concave to embrace one half of the cylinder, or nearly so, but this is not a point of great importance. I commonly use two or more cylinders and concaves, placed below each other, so that the seed may be successively acted upon by the whole of them. The best arrangement I believe to be the employment of two cylinders with their concaves, such as I have described, and a third, not set with card teeth, but with its surface made rough, so that it may act as a rubber. This cylinder may be made of sheet iron punched from the inside in the way well known, or it may be formed of any other substance, or be covered with any article producing the same effect. Such cylinders having been frequently made, I do not claim them as making any part of my invention; I, however, have devised a new mode of constructing the concave in which such a cylinder may run; which concave, or apron, I form of leather, skin, cloth, or any similar material; this concave, or apron, I cause to pass around a portion of the cylinder, sustaining it by its ends upon suitable strips, or rods, to keep it in its place, without any other sup-

port. The part of such leather, or other material which reacts against the roller, may also be covered with any hard or gritty substance.

After the seed has passed the rollers covered with cards, and as it falls from them to the rubbing roller, I sometimes subject it to the action of the fan, operating with sufficient force to drive off a large portion of the chaff without blowing away the seed.

There are to be a feeding hopper, a crank for turning the machine, and the requisite whirls and bands, which do not require description.

What I claim as my invention is the manner in which the wire cards are made and fixed on the cylinders and concaves, as hereinbefore set forth. I do not claim the using of wire cards for the purpose of cleaning clover seed, they having been before so employed, but not operating upon the principle or in the manner in which they are used by me.

I also claim the application of the elastic apron, or concave, to a rubbing cylinder, in the manner, and for the purpose herein explained. The other parts of the machine which I have described, I do not claim.

GEORGE FABER.

Specification of a patent for Stocks for Gentlemen's wear. Granted to EDMUND BADGER, *city of Philadelphia, April* 5, 1832.

To all whom it may concern, be it known, that I, Edmund Badger, of the city of Philadelphia, have invented an improved mode of manufacturing stocks for gentlemen's wear, and that the following is a full and exact description of my said improvement.

I take hog's bristles, and weave them into a webbing, of linen, cotton, silk, or other suitable material; and from this webbing I cut my stocks into the proper form. I then bend them over a mould, or block, to give to them the intended form. Whilst on the block I stiffen them with shellac, or other varnish, after which they are finished by trimming in the usual manner.

What I claim as my invention, and for which I ask a patent, is the weaving of hog's bristles as a filling for webbing to form stocks for gentlemen's wear.

EDMUND BADGER.

Patent for an improvement in the Science of Gunnery, which may be used as a substitute for the ordinary Bomb Shell, or Howitzer; and which may also be substituted for the ordinary cannon shot or musket ball, and ejected from guns of any size or calibre. Granted to WILLIAM B. PIER *and* ANDREW MARK, *city of Detroit, Wayne county, Michigan Territory, April* 6, 1832.

The patentees denominate their invention an "elongated spiral flanched shell," and an "elongated spiral flanched shot." The

first is named from its peculiar form, and is to be cast of such size as shall adapt it to the ordinance from which it is to be projected. For the sake of ready description, a shell adapted to a three pounder is taken as an example. Its form, without the flanches, is that of an elongated egg, with the small end truncated, or cut square off. The length of the shell may vary from one and a half to two or more diameters of the bore of the piece from which it is to be fired. The reason of varying the length is to allow of a larger cavity in certain cases, where it may be required. When the cavity is large, and the shell consequently thin, it is elongated in order to give to it the necessary weight. The large, or forward end, which nearly fits the calibre of the piece, is a solid hemisphere of metal, the weight of which will insure its keeping the proper direction when fired from the piece.

Wings, or flanches, are cast upon the outside; of these there may be four, or more, they extend from the small end of the shell, to the swell of its hemispherical end; their direction is oblique, as they are designed to give to it a rotary motion like that of a rifle ball. Those edges of them which strike the air, are at right angles to the body of the shell, and they extend out therefrom, so that their exterior edges shall every where fit the bore. The angle which they make with a longitudinal section of the shell may vary from five to twenty degrees, more or less, as may be found best to answer the object intended. The diameter of the small or after end, may be reduced to one-third or one-half of that of the bulb or larger end, and the flanches, therefore, widen out in proportion. To charge the cavity of the shell, an opening is left either in the small end, or in the side between the flanches, through which the charge is to be introduced, and the opening then stopped with a screw, or a plug of wood or metal.

The shell is to be made to explode by means of percussion power. For this purpose a hole is to be drilled through the larger end, or bulb, of the shell, in the direction of its axis. This hole may be from one-fourth to three-eighths of an inch in diameter until it reaches near to the cavity, when it is to be continued of such size only as may serve for a touch hole. An iron or steel bolt, surrounded by leather, or other elastic substance, is put over the percussion powder, and extends out from the front of the shell; its exterior end widens out like a nail or bolt head. This striking against any hard substance, occasions the contents of the shell to explode.

The "elongated flanched shot" is similar in its external form to the shell, but as it is to be used as a shot merely, it has no cavity. When used for small arms it is to be cast of lead, to give it sufficient weight. The patentees say that its flight will be more rapid and its range greater than that of a round ball.

Patent for machinery for Jointing Staves with a circular saw; and for Sawing Bilging Staves, by means of concavo-convex circular saws. Granted to PHILIP CORNELL, *Brutus, Cayuga county, New York, April,* 1832.

For a full explanation of the particular construction of this machinery drawings would be required, a general idea of its construction may, however, be given without them.

The jointing apparatus is intended for such staves as are straight upon their edges. The staves are held down upon a carriage by means of a lever, the adjustable bed of the carriage having such an inclination as that rake shall give to the edges of the staves which shall correspond with the size of the vessel to be formed; in this state the carriage is made to advance, carrying the staves against the edge of a circular saw. Several staves, placed one upon the other, are jointed at the same time. There is nothing new in the principle of this part of the machinery, the patent, therefore, is taken for the particular arrangement by which the operation is effected.

For sawing barrel, or other bilging staves, a concavo-convex saw is made, which is a section of a sphere of such radius as shall adapt it to the bilge or curvature of the staves to be sawed by it. The staves are sawed one out of the other, either from plank or rived timber, of such thickness as the width of the stave may require. The carriage upon which the stuff to be sawed is fixed, has curved ribs, or guide pieces, taking into corresponding grooves in the bed upon which it runs, the radius of their curvature corresponding, of course, with that of the saw used.

The carriage is driven forward by means of an endless screw, a rack and pinion, or other suitable contrivance.

Sometimes an apparatus is used which joints the stave, giving the proper curvature and rake to the edges, at the same time that it is cut by the concavo-convex saw. This apparatus consists of two circular saws running on separate axes, and contained each in a sliding frame, governed by grooved guide pieces in such a way that as the stave advances against them they joint it in the manner described. We believe, however, that the machinery is rendered too complex by this addition, and that the patentee prefers to perform the operations separately. The patentee says:

"What I claim as new in the before described machinery, and for which I ask a patent, is the apparatus for jointing straight staves several at a time, one edge only, by means of a circular saw, and giving to them the proper bevel, as herein set forth. I also claim the sawing of bilging staves by means of a circular concavo-convex saw, whether the same be done by using a carriage upon the construction set forth in this specification, or by placing the saw itself upon a moving carriage. For although I have described and represented certain frame work, and modes of communicating motion, I lay no claim to this particular arrangement of the accessory parts of the machinery."

Specification of a patent for an apparatus for Holding and Guiding Edge Tools in the operation of Grinding. Granted to GEORGE A. MADEIRA, *Chambersburg, Franklin county, Pennsylvania, April* 19, 1832.

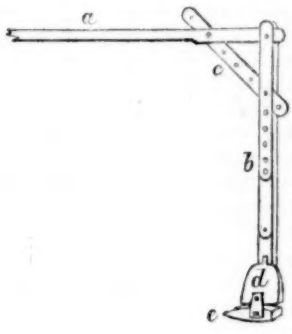
To all whom it may concern, be it known, that I, George A. Madeira, of Chambersburg, Franklin county, Pennsylvania, have invented an apparatus, or machinery, for holding and guiding edge tools, and other articles in the operation of grinding, which apparatus greatly facilitates the said operation, and will enable an inexperienced hand to perform it with precision; and that the following is a full and exact description of the said apparatus.

I use a spring pole, which is fixed along or near to the ceiling of the room or workshop, in the manner of those used for the pole lathe. The elastic end of this pole is directly over the grindstone, and from it descends a part which I denominate the hanger; the hanger is hinged or jointed to the spring pole, so that the angle which they make with each other may be varied. A brace passes diagonally from the spring pole to the hanger, a mortise being made through each for that purpose. This brace may be lengthened or shortened by means of pins, which pass through holes in it, and in the spring pole and hanger, and serve to confine them in any required position.

In order to adapt the hanger to articles of different sizes and kinds, it is made capable of being lengthened or shortened; this may be effected by dividing it and making one part to lap over the other, or by a long slot in one piece, and a corresponding tongue on the other, with equidistant holes through them, and pins or screws to adjust or confine them.

To admit of the article which is to be ground being moved backward and forward on the stone, there is a hinge, or rule joint, near the lower end of the hanger; and to allow of its transverse motion, the block upon the under side of which the article is to be held, is attached to the hanger by a hinge, or rule joint, in the reverse direction.

The block must vary in its form and construction according to the nature and form of the article to be ground; and the articles may be held in their places by means of screws, wedges, or otherwise. No particular directions can be given for this part, nor is it necessary, as every workman can readily adapt the block to the particular purpose which it is required to answer. The block is sometimes made with a handle projecting from each side of it, one for each hand. When axes, or other articles with eyes in them, are to be ground, the handle may pass through the eye, and form one part of the arrangement by which it is attached to the block.



I have thus described the manner in which I ordinarily form this apparatus; it, however, is susceptible of various modifications, whilst the general principle of its structure and action remains unchanged. I do not, therefore, claim the exact and particular formation thereof as herein set forth, but what I claim as my invention, and for which I ask a patent, is the use of a spring pole, with a descending part, which I have called the hanger, and a piece at the bottom thereof, similar to what I have denominated the block, to receive and hold the article to be ground; the apparatus being furnished with joints to admit of motion in two directions, and being adjustible in its length, to suit different articles.

GEORGE A. MADEIRA.

Patent for an improvement in the mode of Bleaching Yellow Bees-wax. Granted to JOHN N. SHULTZE, *Chemist, city of New York, April* 30, 1832.

Four vats are to be prepared which may each be about four feet long, three wide, and three deep; these are to be placed side by side, to facilitate their use. They may be numbered 1, 2, 3 and 4. Into No. 1, 200 lbs. oxymuriate [chloride] of lime, and 125 gallons of water are to be put; the mixture is to be well stirred, and the impurities allowed to settle. 500 lbs. of yellow wax are to be put into No. 2, and heat applied, either by steam or otherwise, sufficient to melt the wax, which is allowed to remain at rest, that its impurities may settle. The clear melted wax, and portions of the solution of oxymuriate of lime, are to be laded into vat No. 3, heat being applied to keep the wax melted, which, however, is not to exceed 160°. Nearly all the solution of oxymuriate will in general be used in this first process, which, however, will in general but partially bleach the wax. The mixture is to be constantly stirred for about an hour, in which time this first operation will be completed. A mixture, consisting of twenty pounds of sulphuric acid, diluted with thirty of water, is then added, and agitation kept up for half an hour. The acid, combining with the lime, sinks it to the bottom, and leaves the bleached wax floating above it; this settling is effected in about half an hour. The process has sometimes to be repeated a second or third time, depending upon the portion of colouring matter in the wax.

When the wax has been thus sufficiently bleached, it is put into vat No. 4, and as it still contains some water, this is to be separated from it. To effect this, thirty pounds of common salt are added, which being soluble in, unites with, the water, and the weight of this solution causes it to separate from, and descend below, the wax, which thus acquires a clear and transparent appearance.

To improve the white appearance of the wax, an ounce of pulverized Antwerp blue, previously mixed with a quart of the melted wax, is poured into vat No. 4, when the whole is deposited in proper vessels.

ENGLISH PATENTS.

Specification of the patent granted to GEORGE FORRESTER, *Civil Engineer, for certain improvements in Wheels for Carriages and Machinery, which improvements are applicable to other purposes. Dated September 5,* 1831.

To all to whom these presents shall come, &c. &c. —*Now know ye*, that in compliance with the said proviso, I, the said George Forrester, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, (that is to say)—

My invention consists in a peculiar mode of combining cast iron with wrought or malleable iron in the construction of wheels of all descriptions, (excepting those of such small dimensions as the wheels of clocks and watches,) and in the application of the same principle of construction to the framing for steam engines and machinery, the arches of bridges, and in every case in which cast iron framing may be employed, and wherein great strength and lightness are desiderata.

My mode of accomplishing the aforesaid combination is as follows: I make a skeleton, or light frame, of wrought iron, or steel, of the shape of the article required, but of considerably less dimensions; this skeleton I render bright, free from oxide, and clean, by any convenient operation, such as grinding, scouring, and filing, to adapt it to receive a coating of lead, or bismuth, or tin, or zinc, or any mixture of those metals, such coating being performed by similar means to that used in the well known process called "tinning." The article to be cast having been moulded in sand (or loam) in the common way, the skeleton, coated as before mentioned, is carefully laid in the middle of the respective parts of the mould, projecting pieces being attached to the skeleton to keep it in its proper place; the mould is now to be closed, and the cavities formed by the pattern are to be filled up with fluid cast iron, which completes the operation.

By this mode of embodying or enveloping wrought iron or steel skeletons of the shape of the intended article, with cast iron, the latter material is not injured in its tenacity, while the former is considerably improved, and thus the important qualities of toughness and infrangibility are introduced into forms more perfect, and structures more solid than can be obtained in wrought iron alone. To prevent misconception, I annex a drawing illustrative of the construction of one of the leading objects of my invention, that of wheels for rail-way carriages, and which will also serve satisfactorily to explain the mode of applying the principle of construction to the purposes before named.

Description of the drawing.

Fig. 1 exhibits a side view of the wrought iron or skeleton framing before described.

Fig. 2 shows an edge or outside view of the peripheral ring of the skeleton, showing its proportional breadth, and containing a number of holes made throughout its circumference, for the purpose of allowing the fluid iron, in casting, to flow through the holes, and fix itself in a solid mass around the skeleton.

Fig. 1. *Fig.* 5. *Fig.* 3.

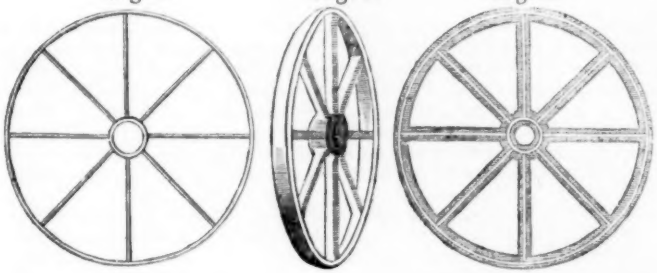


Fig 2 *Fig* 4

Fig. 3 represents a section of the wheel in the line of its motion, the blank line showing the skeleton embodied in the cast iron.

Fig. 4 shows a section of the wheel through its diameter, including two of the spokes; and fig. 5 affords a perspective view of the entire wheel. [*Rep. Pat. Inv.*

ANALYSIS OF THE REPORT, &c. ON STEAM CARRIAGES.

Report on Steam Carriages by a Committee of the House of Commons of Great Britain. With the minutes of Evidence, and Appendix. Reprinted by order of the House of Representatives of the United States. (1832.)

(Continued from p. 180.)

We apprehend that the minutes of the evidence before the committee will prove of more interest than the report itself.

The witnesses examined in relation to the progress, &c. of this branch of locomotion, were Messrs. Goldsworthy Gurney, Walter Hancock, Richard Trevithick, Nathaniel Ogle, Alexander Gordon, Joseph Gibbs, William Altoft Summers, and James Stone, who as inventors and patentees of different steam coaches, or as connected with them, must be considered in the light of interested witnesses; John Farey, Thomas Telford, Thomas M'Adam, and John Macneil, well known as civil engineers, Davies Gilbert, ex-president of the Royal Society and member of the committee on steam carriages, and Col. Torrens, a member of the same committee, having no other than a general interest in the progress of the invention.

From the testimony of Messrs M'Adam and Macneil, we shall derive useful information in relation to the turnpike roads of England,

and to the effects produced upon them by various agents. The remarks will be found less applicable than could be wished to roads in our own country, similar only in name to most of those spoken of.

We proceed with a condensed view of the more interesting parts of the evidence, quoting when the importance of the subject, or the method of handling it, requires such a course.

Mr. Gurney states that in his first attempts to propel coaches by steam, he used a propeller, or leg, projecting from behind the coach, that subsequently having found the adhesion of the two hind wheels sufficient, the propeller was only applied in ascending hills; that the adhesion proving sufficient in this case also, even with one wheel, the propeller was entirely laid aside. To prevent slipping, the steam is let very gradually upon the piston, ("wire-drawn.") He states several hills which his coach ascended, (Highgate hill, Stanmore hill, &c.) but does not give their elevations. These experiments were made in 1826.*

In 1827 further experiments were made which showed the practicability of using the steam coach to drag a second coach after it. A trip was made in one trial (load not stated) in which the carriage went 84 miles in ten hours, including stoppages. The weight of the steam carriage was, in this stage of its improvement, reduced from four tons, to thirty-five cwt. One of the coaches actually running between Gloucester and Cheltenham, is certified to weigh nearly three tons: this was not built by Mr. Gurney, though upon his plan. The hind wheels of Mr. Gurney's coach are five feet in diameter, the fore wheels one foot less. It is proposed to use smaller wheels when power, and not speed, is required. The tires of the wheels are three and a half inches wide, those of a common stage coach being about two inches. This carriage is upon springs, it is calculated (weight thirty-five tons,) to do the work of about three and a half horses.

Mr. Gurney calculates that three and a half bushels of coke and seventy gallons of water, are a charge for a stage of about seven miles when the roads are bad, requiring about half this quantity when they are good. The wear of the roads by this carriage is stated to be the same as that of ordinary carriages, estimating by the relative wear of the tires of the wheels of the two kinds of coaches.

The fuel used being coke, there is no smoke, and the escape steam is conducted into a peculiarly constructed chamber, so as to prevent noise. Horses sometimes start at the unusual appearance of the carriage; there should be in a well constructed engine no noise to alarm them.

From a clay rut of eight inches deep, the carriage was propelled by attaching a second wheel; up hills the friction of two wheels was frequently necessary. The stroke of the piston in the engine of this carriage is about eighteen inches. The pressure of steam used seventy pounds. The boiler tubes from half an inch to two inches in diameter, their thickness about the eighth of an inch, they are proved to about 800 lbs.

The carriage can be stopped within a few (six or seven) yards, by reversing the communication of the steam with the piston. Both carriages, when moving slowly, may be readily turned, the inner circle being about ten feet in diameter. The only accident which Mr. Gurney himself had met with in experimenting, was in the carriage moving too rapidly down hill (from carelessness in neglecting to lock the wheel,) and becoming unmanageable.

These carriages may be moved more economically upon paved roads, but on ordinary turnpikes they will answer. Not more than one-fourth of the power required upon a gravelled road is expended in moving over a pavement.

Mr. Gurney proposes that a toll should be exacted in proportion to the ratio of weight of a carriage, and to the average weight of a horse, which he fixes at ten cwt. He is of opinion that the hoofs of a horse would injure a road much more than the same weight upon wheels. At a rate below four miles an hour

* Those of Evans, it will be recollected, were made in 1804.—Reviewer.

a greater expense would be incurred by moving a burthen by steam than by horses; above four miles an hour, the economy is in favour of steam, the gain increasing with the speed.

Mr. Gurney has run at the rate of from eighteen to twenty miles an hour; there was no sort of difficulty in guiding the carriage when moving at the rate of twelve miles an hour.

From certain calculations, the details of which are submitted to the committee, Mr. Gurney concludes that steam-stage coaches may be run at about one-fifth the cost of the common coaches. The items are, first cost, wear and tear, and keeping. The details, if accurate in England, would be inapplicable here.

Mr. Gurney values a horse power at nine gallons (average) of water evaporated in one hour, under either high or low pressure. The rapidity of motion of a carriage, by enabling it more readily to overcome obstacles, is favourable to economy, so that a piston moving at the rate of fifty feet per minute will require more fuel to do a given work than if travelling at the rate of two hundred feet per minute.

Charcoal is sometimes used as fuel in the steam carriage, but more usually coke; there would be great economy in using coal, but the smoke would prove an annoyance on the road. Mr. Gurney asserts to have made experiments on a large scale, in which he found that smoke could not be completely consumed by any draught; he supposes the particles of carbon to be so surrounded by carbonic acid as to prevent combustion, requiring this gas to be removed before smoke can, by a supply of air, be entirely consumed.

In relation to the explosion of boilers, Mr. Gurney is of opinion that they are produced by some new and at present unascertained compound of hydrogen, oxygen, and nitrogen.

The explosive compound is supposed to be formed at high temperatures, and to come in contact with substances capable of decomposing it, when an explosion is produced.

This idea is supported by a reference to certain opinions of Gay Lussac, that there *may be* compounds of hydrogen and oxygen yet undiscovered; a very philosophic admission from which Mr. Gurney draws, in a strange manner, authority for this new compound. He asserts that there is but one compound of hydrogen and oxygen acknowledged in England, though two are admitted by French chemists; any elementary work would have corrected such an idea, and would also have shown him what are the "certain substances" by contact with which the deutoxide of hydrogen may produce explosive effects.

Mr. Gurney gives an account of the explosion of a cauldron in a brewery, which he advances to prove his hypothesis, suddenly leaving it when we suppose him about to draw the conclusion. He reasons thus; before the open cauldron exploded, a gelatinous matter had formed and prevented the contact of the water with the bottom of the cauldron, which thus became heated, and the compound was formed: now we expect the compound to explode, instead of which "the rupture of this film, and the sudden contact of water against the hot surface below, produced such an immense and sudden volume of steam that it burst the boiler." Exactly as the rupture of a film of dirt, or of carbonate or sulphate of lime would have done.

Mr. Gurney uses fusible plates to prevent the undue heating of the parts of his boiler, and a glass gauge to indicate the level of the water within, besides the usual stop cocks. His indicator of the pressure of steam is a weighted piston.

On ordinary roads it would not be reasonable to expect a steam carriage to draw more than its own weight. On ice the wheels require roughing; in deep snow the progress is very difficult; when ice is below the snow it becomes soon compacted, and the carriage passes forward readily.

Mr. Gurney goes into an examination of the benefits which would be derived from the substitution of steam power for horse power; the argument is true every where, but derives its force from the peculiar condition of England. We quote at length.

"I would state generally, in regard to the main improvements on steam engines, by which this country has been so much benefitted, and the prospects of advantages arising from steam carriages, that they have almost always been in a direct ratio with that of removing of horses; that the great and splendid improvements of Mr. Watt have generally been supposed to be principally connected with the separate condenser of the steam engine, and the saving of the fuel; but before Mr. Watt's day, we could empty our mines of water in Cornwall, and we could do a variety of other simple work by the steam engine, and so far the improvement of Mr. Watt was simply with respect to the saving of fuel; but I consider that the great national advantage arising from Mr. Watt's improvement, has been his application of the steam engine to machinery; and the extent of that advantage to the community has been in a direct proportion to the removal of horse power, a most unproductive labourer, and a dead expense to the country. If this view of the subject be entertained, the application of steam to propelling carriages on common roads, will be as important above its application to machinery generally, as the number of horses employed in locomotion exceeds that necessary to machinery, which bears no proportion with respect to each other. At Hounslow alone, there are at this moment upwards of 1,000 horses employed in stage coaches and posting. On the Paddington road, a distance of five miles only, there are upwards of 1,000 horses employed at this moment. Throughout Great Britain it is almost impossible to say how many horses are employed, but I should perhaps be within bounds if I were to say millions, in posting and stage coaches. If it is possible to remove those horses by an elementary power, which I firmly believe is practicable, the national advantage must be in proportion to the number of horses so removed; for if it is shown that one carriage horse can be removed from the road by the present state of steam carriages, I see no reason why every horse so employed should not be so removed. It has been decided that the consumption of a horse is equal to that necessary for eight individuals, so for every horse that is removed and is supplied by elementary power, we make way for the maintenance of eight individuals. If it is possible to carry the idea so far, and I see no objection to it, to do the principal work of horses by steam, or if it can be done by elementary power, the committee may imagine to what extent we may provide for our increasing population. I think we may do much by political laws and enactments, but natural laws will do more, and when pointed out by the finger of Providence, may be made to provide for his wise dispensations. I firmly believe that the introduction of steam carriages will do more than any other thing for this country. I have always had this impression; I left an honourable and lucrative profession, in which I was extensively engaged, in order to attend to this subject, because I was convinced of its importance and practicability; I have always entertained the same idea as I do at present. Imperfections will exist in the machinery; but I conceive that the main points of difficulty have been removed by the experiments I have made, and that all

those now remaining are practical difficulties, which will be removed by further experience; and if there is no cause opposed by the Legislature, or any other source, I will be bold to say, that, in five years, steam carriages will be generally employed throughout England. I have not hesitated, having these feelings, to devote all my time for the last six years to the subject, and am mentally recompensed by the present state of the subject. Private carriages also will be used. Under this opinion I have given directions for building a small one. I expect it will go quicker, safer, more easily, and certainly more independently than a common carriage, because it does not need the food of a horse."

To provide against accident in case the guide of the steam carriage should fall asleep, or be thrown from his place, Mr. Gurney has contrived to cause the steam valves to remain in gear only while the foot of the guide presses upon the apparatus. The same contrivance applies to moving down hill.

The next witness examined was Walter Hancock, also engaged in projects for locomotion.

Mr. Hancock states that he has been running his coach about twelve months, the stage is four miles, water being supplied at every eight miles. The quantity of water required for the eight miles is stated to be seven cwt. and of coke two bushels, or one-fourth of a bushel per mile. When the roads are good, the engine is worked at about seventy pounds per square inch upon the safety valve. The boiler used is Hancock's chamber boiler, and is thus described.

"There are flat chambers which are placed side by side, the chambers being about two inches thick, and there is a space between each two inches; there are ten chambers, and there are ten flues, and under the flues there is six square feet of fire, which is the dimension of the boiler top and bottom. The chambers are filled from half full to two-thirds with water, and the other third is left for steam: there is a communication quite through the series of chambers top and bottom; this communication is formed by means of two large bolts, which screw all the chambers together; the bottom bolts, the bottom part of the chambers, and the top bolts, the top part of the chambers; and by releasing those bolts at any time at all, the chambers fall apart, and by screwing them they are all made tight again. We have braces to fasten them; the steam is driven out from the centre of one of the flues, and the water is ejected from the pump at the bottom communication for the supply of water."

The iron of this boiler was an eighth of an inch thick.

In a carriage weighing 35 cwt. Mr. Gurney required 700 lbs. of water to go seven miles, and three and a half bushels of coke. Pressure about 70 pounds to the square inch. Mr. Hancock's carriage weighing from sixty to seventy cwt. consumes 784 lbs. of water in eight miles, (686 lbs. per seven miles,) and requires two bushels of coke (one and three-fourths bushels for 686 lbs.) to convert it into steam. Pressure as above. The economy would appear greatly in favour of Mr. Hancock's boiler (as .57 to 1,) if the number of either patentee can be relied on as more than a rude approximation.

In Mr. Hancock's carriage the passengers are in the front part of the coach, and the engine is between them and the boiler, which is placed behind. The guide is in front. The carriage weighs about seventy cwt., and carries ten passengers. Breadth of the tires about three and a half inches. Diameter of hind wheels four feet, but should be five.

Every part of the engine is upon springs. The power is communicated by two cranks, one attached to the piston of each cylinder. The cylinders are

nine inches in diameter, and the piston has twelve inches stroke. The carriage is sixteen feet long. The steam when escaping is thrown into the fire to prevent unpleasant noise, which is calculated, beside, to alarm horses on the road.

Mr. Hancock gives an instance of the bursting of one of the chambers of his boiler without noise or danger, and supposes them very safe, since steam is not allowed to accumulate in them, but is removed as fast as produced.

The carriage may be turned in an inner circle of four feet, and outer of ten feet radius. Mr. Hancock thinks that by reversing the motion of the engine he could stop, when going at the rate of eight miles an hour, in about twelve feet, or even in four feet.

A system of tolls is thought best which shall charge stage coaches in proportion to their weight, or to the number of passengers which they can carry.

In overcoming a hill, which is mentioned, the difficulty of forcing the coach up in frosty weather, by the adhesion of a single wheel, is spoken of. When the roads are neither very wet nor very dry, the travelling is the most unfavourable.

Mr. Hancock thinks that the fare could be reduced to two-thirds of that asked by the stage coaches, and that 100 miles could be accomplished in ten hours, including two hours of stoppages.

The evidence of Mr. Farey we propose to give somewhat in detail; as an engineer his name is well known, and having no share as a patentee, nor any direct interest, in the various projects, his evidence may be regarded as professional in its character, and without any special bias. Hence his remarks upon locomotion in general, upon the relative advantages of the different plans, upon the manner in which it may be helped forward by the government, &c. are of special interest. His evidence is less interrupted by queries, and the information better put together than those of the patentees.

"Have you turned your attention to the subject of propelling stage coaches or other carriages, by steam power on common roads, instead of by horses? I have had occasion to prepare specifications of several such inventions for which patents have been taken out, and have, in consequence, paid a close attention to that subject. I have also been consulted to settle the plans for the practical execution of steam coaches, but I have not directed or superintended any such execution myself. Of the specifications I have prepared, three have been followed up by building coaches, which have actually travelled on common roads; viz. Mr. Gurney's, Mr. Hancock's, and Messrs. Heaton's. I believe those three are the only trials, amongst many others, which have had so much success as to have been persisted in to the present time. I have examined other steam coaches, but they had no chance of success, and have been abandoned.

"Will you state, generally, your opinion as to the probability of this mode of propelling carriages superseding the necessity of using horses? All that has been hitherto done, or which is now doing, in that way, must, I think, be considered as experimental trials. I have no doubt whatever but that a steady perseverance in such trials will lead to the general adoption of steam coaches, and that, at an earlier or later period, according to the activity and intelligence with which an experimental course is conducted; and I am firmly convinced that the perfection which is essential to their successful adoption will never be attained by any other course than that of reiterated trials. The difficulties with which the steam coach inventors are at present contending, are chiefly of a practical nature, which I think, are not likely to be avoided by any great efforts of genius or invention; but I expect that they may be surmounted one after another by the experience which may be gained by competent mechanicians in a course of practice. I do not look for much more invention as necessary to the establishment of steam coaches; but it is certain that the practice is indispensable.

Each of the three inventors I have named has brought his steam coach to that state which renders it a full sized model for making such experiments as serve to prove the principle of action, and to teach how a better coach may be made the next time, but nothing more. The probability that such next better coach will be sufficiently perfect to answer as a trading business, depends as much upon the natural judgment and acquired skill of each inventor, as upon the qualifications of his present production."

"Has the experience which has already been had of steam carriages been such as to enable us to say that it is not merely in theory we have calculated on these carriages? Yes: what has been done by the above mentioned inventors, proves to my satisfaction the practicability of impelling stage coaches by steam on good common roads, in tolerably level parts of the country, without horses, at a speed of eight or ten miles an hour. The steam coaches I have tried, have made very good progress along the road, but have been very deficient in strength, and consequently in permanency of keeping in repair, also in accommodation for passengers and for luggage; for which reasons they are none of them models to proceed upon to build coaches as a matter of business. From the complexity of their structures, and the multiplicity of pieces of which they are composed, it is impracticable to give them the requisite strength by mere addition of materials, because they would then be too heavy to carry profitable loads as stage coaches. I do not consider that it is now a question of theory, for the practicability I conceive to be proved; but many details of execution, which are necessary to a successful practice, are yet in a very imperfect state. My view of the subject will be best understood by stating, that I believe an efficient steam carriage might now be made merely to carry despatches, by following the general plan of the best steam coach which has yet been produced, improving the proportions wherever experience has shown them to be faulty, using the very best workmanship and materials, and giving a judicious increase of strength to the various parts which require it, allowing all the weight of a load of passengers and luggage, and of the accommodations for them, in additional strength of materials, so that the total weight of the coach, without any passengers or goods (beyond the people and stores necessary for its own use and one courier,) should be as much as the weight of the previous model containing a full load of passengers and luggage. If three such coaches were constructed, one of them might start every morning at each end of any fair line of road 100 or 120 miles long, and one would arrive every evening at each end of that line in less time than a common stage coach; and I should expect that, after twelve months' perseverance, and after making all the improvements and alterations in the machinery which so much experience would suggest, the double passage ought to be made with as much safety and punctuality, and with much more expedition, than by the mail. The road between London and Bristol might be taken as a suitable line, but I should expect a pair of horses to be provided at every notable hill, to help the steam carriage up it. Such a proposition, it is obvious, offers no inducement to individuals, because it would be all expense without any return; but if it were judiciously done at public expense, I have no doubt but that it would lead to as much improvement in the mode of execution of future coaches as would enable them to be run permanently as stage coaches with profitable loads. The great defect of all the present models, is want of strength to resist the violence to which they are subjected in rapid travelling with a full load; and if that strength were given upon the present construction by the mere addition of materials, they would become too heavy to be efficiently propelled, even if they carried no load in them."

"As far as your experience has gone, which plan of steam carriage do you think will hereafter be most generally resorted to, that of an engine carriage drawing after it another carriage containing the passengers, or of conveying the passengers in the carriage in which the machinery is placed? I have not had experience in drawing by two carriages, except by the analogy of what is done on rail-ways, and hence I feel some difficulty in speaking positively upon

that point. There are advantages and disadvantages to be considered in both modes, but all the mechanical considerations incline to one side, viz. to place the engines in the same carriage with the passengers. That plan will certainly be lighter than when two separate carriages are used, and also the weight will be laid on those wheels which are turned by the engines, as it should be, to give them a firmer adherence to the road; also one carriage will steer and turn much better than two, and will go safer down hill, and will be cheaper to build and to work."

"By that means great weight is saved? Yes; perhaps one-third is saved in exerting an equal power. In stating my opinion of the probability of a profitable result, after twelve months' trial of three coaches to run regularly two hundred miles every day, with despatches only, I contemplated that the engines and passengers would be, ultimately, in one carriage, because that plan has a most decided mechanical advantage in making progress along the road, and also in facility of steerage, and safety in going down hill, and fewer servants are required to manage one carriage than two. On the other hand, all the constructions that have yet been tried with one carriage, subject the passengers to more or less occasional annoyance from heat and noise, smoke and dust, and there is still an apprehension of danger from the boiler: hence passengers will invariably prefer to go in a separate carriage to be drawn by the engine carriage; that mode also offers a facility of changing the engine for another, or for post horses, in case it gets deranged, because the change may be made without unloading, and discomposing the passengers. For common stage coaches these are strong motives to use a separate carriage, and if it can be brought to bear in comparison with horses, that mode will probably be most generally adopted by the influence of the passengers, although the other mode will inevitably perform the best and attain the greatest speed of travelling."

"Taking the two machines of Mr. Gurney and Mr. Hancock in their present state, do you think them entirely free from defects likely to prove dangerous to travellers? I do not think the danger is at all considerable in either Mr. Gurney's or Mr. Hancock's: there are dangers in all travelling; but I do not think the amount of danger will be at all increased by substituting steam for horses, according to either of those plans."

"The question refers to the peculiar danger from the nature of the propelling power? I am not inclined to think that there is any peculiar danger which would be incurred by the change; and if the engines and passengers are not on the same carriage, I think the ordinary danger would, on the whole, be diminished."

"The question is with reference to the relative danger of travelling ten miles an hour when drawn by horses, and when propelled by steam at the same rate? The danger of being run away with and overturned is greatly diminished in a steam coach. It is very difficult to control four such horses as can draw a heavy stage coach ten miles an hour in case they are frightened, or choose to run away, and for such quick travelling they must be kept in that state of courage that they are always inclined for running away, particularly down hills, and at sharp turns in the road. The steam power has very little corresponding danger, being perfectly controllable, and capable of exerting its power in reverse, to retard in going down hill; it must be carelessness that would occasion the overturning of a steam carriage, which carries the passengers in the same carriage with the engines. The distinct carriage I consider to be much less controllable in turning corners and going down hill, but yet far more so than horses. The chance of breaking down has hitherto been considerable, but it will not be more than usual in stage coaches when the work is truly proportioned and properly executed. The risk of explosion of the boilers is the only new cause of danger, and that I consider not equivalent to the danger from the horses. There have been, for several years past, a number of locomotive engines in constant use on rail-ways, all of them having large high pressure boilers, very much more dangerous than Mr. Gurney's or Mr. Hancock's, whether

we consider the probability of explosion, or the consequence likely to follow an explosion, because, being of large diameters, they are less capable of sustaining the internal pressure of the steam; and, also, they contain a large stock of confined steam and hot water. The instances of explosion among those locomotive engines have been very rare indeed."

"Have you seen Mr. Hancock's last improvement? Yes; I consider Mr. Hancock's boiler to be much better for steam coaches than any other which has been proposed, or tried."

"If that boiler were to explode, it is understood that there would be no danger at all? It is very difficult to foresee that; at the same time, the risk of explosion in Mr. Hancock's boiler is certainly very much less than in the locomotive boilers which are in constant use on a large scale on rail-ways, and where we have proof that the extent of the danger is very small."

"Do you think his boiler might explode without the passengers knowing any thing about it? The metal plates of which the boiler is composed will burn through by the continuance of the action of the fire, and may crack or open so as to let the steam or water out of the boiler and disable the coach from proceeding, but that is hardly to be called an explosion; no one would be hurt. The crack which lets out the hot water is sure in that case, to throw it into the fire and not on the passengers."

"You consider the danger to passengers by the chance of bursting of a boiler as not equivalent to the danger of horses running away? It is not equivalent, in my opinion; the probability of a coach being overturned by the horses is far greater than that of a boiler bursting, and when either accident does occur, the probable extent of mischief from an overturn in which all the passengers must participate, is much greater than could be expected from the bursting of a boiler, which must always be kept at a considerable distance from the passengers on account of the heat."

"Supposing either Mr. Hancock's or Mr. Gurney's boiler were to burst; in the one case the boiler being in a separate carriage, and in the other, the boiler being at considerable distance behind the passengers, what danger do you think could arise to the passengers from the bursting of the boiler? There is very little difference between the two cases: the separate carriage obviates any apprehension that passengers could entertain from the danger of explosion, and will therefore be preferred by most passengers; but, for myself, I do not rate that risk so high as to be induced to encounter the complexity of the two carriages, and to forego some of that new security compared with horses which steam power offers by its controllability in descending hills and turning corners; and from which circumstance, as I have before stated, I think the plan of one carriage is much to be preferred, and probably the other objections, of heat, and noise, and dust, may be overcome by some new means, which have not yet been shown. In Mr. Hancock's carriage the boiler is quite behind, and away from the passengers, so that they are out of danger, if there is any, and are not materially annoyed by heat, or smoke, and dust, except at times when the wind brings it forward, and that rarely happens when the coach is moving."

"Is not the danger attendant on the bursting the boiler greatly diminished by the subdivision of its internal capacity into tubes, or small and flattened chambers? Unquestionably, until the danger of explosion has become exceedingly small; but the great difficulty of boilers for steam coaches is, that the liability to burn through the plates has been increased by that expedient for ensuring safety; and the progress of the invention has been impeded between those two difficulties, in a greater degree than from any other circumstance. It was a desideratum for a long time to contrive a boiler, which, being made of such thin metal as would not render it too heavy, should have sufficient strength to retain high pressure steam without danger of bursting; also that it should expose a sufficient external surface of metal to the fire and flame, and of internal surface to the contained water, to enable the required quantity of steam to be produced from such a small body of water as could be carried, on account of

the weight: both these conditions were fulfilled by subdividing the contained water into small tubes, or into flat chambers, which expose a great surface in proportion to their internal capacity, and admit of being made strong with thin metal; but there is also another condition which is rather incompatible with the two former, viz. that there shall be such a very free communication between the interior capacities of all the tubes or narrow spaces, as will combine them all into one capacity, and permit the contained water to run from one to another, and also permit the steam, which is generated in innumerable small bubbles within the narrow spaces, to get freely away from them, and go to the engines without accumulating and collecting into such large bubbles as would occupy the spaces and displace or drive out the water before them; for, if that effect takes place, it produces three great evils; the water boils over into the engines along with the steam, and is wasted, and the thin metal which remains exposed at the outside to the fire, becomes burning hot in an instant, after the water is so driven away from the internal surface, and the further production of steam is suspended so long as the water continues absent. If such displacement of the water takes place frequently, and in many of the narrow spaces at once, the boiler will not produce its proper quantity of steam, and the thin metal will soon be burned through, and destroyed by the fire."

"Have you seen Mr. Hancock's boiler? Yes; I have had many trials of it; and I am well acquainted with Mr. Gurney's. The former uses flat chambers of thin iron plate, standing edgeways upwards over the fire in parallel vertical planes; the latter uses small tubes (such as gun barrels are made of,) to contain the water, the fire being applied on the outsides of the tubes. In Mr. Gurney's boiler I think the subdivision of the water into small spaces is carried too far, because the steam cannot get freely away out of such small tubes as he uses (and they are also of great length) without displacing much of that water which ought always to be contained within them. By an ingenious arrangement of connecting pipes and vessels, which he calls separators, he collects all the water which is so displaced along with the steam, and returns it again into the lower ends of the same tubes, and thus avoids the evil of water boiling over into the engines; but that makes only a partial remedy for the diminished production of steam, which is attendant on the absence of the water from the heated tubes, and the still greater mischief of burning and destroying the metal. Hence the evil of burning out the tubes is very great. Also his separators hold a considerable weight of water, from which no steam is generated; and they require to be heavy in metal, to render them quite safe and strong. Mr. Hancock has taken the middle course in subdividing the water in his boiler, having all that can be required for safety, and the weight, I believe, on the whole, to be less than that of any other boiler which will produce the same power of steam; for, owing to the freedom with which the steam can get away in bubbles from the water, without carrying water with it, the surface of the heated metal is never left without water. Hence a greater effect of boiling is attained from a given surface of metal and body of contained water, and that with a much greater durability of the metal plates, than I think will ever be obtained with small tubes."

"Do you think there is a danger of such an explosion as could do injury from the mode in which Mr. Hancock's boilers are constructed? That danger I hold to be very slight; the metal of Mr. Hancock's chambers will burn through in time, the same as that of Mr. Gurney's tubes will do, but not so soon. I think, taking the thickness of metal to be the same in both cases, no injury will be done by such burning through. The flat chambers in Mr. Hancock's boiler are very judiciously combined, and are secured against bursting by causing the pressure which tends to burst each one open, to be counteracted by the corresponding pressure of the neighbouring chamber, and the outside chambers are secured by six bolts of prodigious strength, which pass through all the chambers, and unite them all together so firmly that I see no probability of an explosion. Mr. Gurney's vessels, called separators, are secured by hoops round them, and, being of a small size, may be made very safe. Hence I think the

two boilers may be put on a par as to their security; but there is a decided preference, in my opinion, of Mr. Hancock's form of subdividing the water and steam compartments, which I believe is carried too far in Mr. Gurney's tubes, whereby the water included within the several tubes, cannot make way to allow the bubbles of steam to pass by it. This is owing to the great length and the small bore of the tubes; and they are so isolated one from another, that the water within them is not able to act as a common stock of water, or to keep all the interior surfaces of the metal tubes thoroughly supplied with water: thence, there is a deficient production of steam and an unnecessary destruction of metal."

"Are you aware that in Mr. Hancock's carriage, the waste steam, which is discharged from the engines after having performed its office, is thrown into the fireplace, and makes its escape upwards along with the flame, smoke, heated air, and gas, which ascend from the fire, to act on the boiler? That is the way in which he gets rid of the waste steam which the engines discharge, and I understand that he thereby avoids the puffing noise and appearance of steam which is common with high pressure engines. Mr. Hancock blows the fire with a current of air produced by a revolving fanner, which is turned rapidly round by the engines, and therefore he requires no tall chimney to produce a draft. Mr. Gurney formerly used a fanner to blow the fire, and also a chimney of some height; but I understand he has lately laid the former aside, and adopted the plan of carrying the waste steam, which has passed through the engines, into the bottom of the upright chimney, and there discharging that steam through a contracted orifice in a vertical jet, which, by rising upwards with great velocity in the centre of the chimney tube, gives a vast increase to the draft of heated air and smoke in the chimney tube, without any great height being necessary; and this plan occasions a most active current of fresh air to pass up through the fire, and urge the combustion. This is a most important improvement in locomotive engines, which has been introduced by Mr. Stephenson into his engines on the Liverpool and Manchester railway, and being there combined with an improved boiler, it has been one of the great causes of the brilliant success of that undertaking. I believe the same plan will be indispensable to the complete success of steam carriages; for chimneys cannot be used high enough to obtain a draft, and blowing the fire is a very troublesome affair. I fear Mr. Stephenson's plan would occasion more noise than is allowable on common roads; but that may perhaps be avoided, or diminished, by some new expedient."

"Do you think any danger would arise from the waste steam being discharged over a large mass of fire on Mr. Hancock's plan? Not the least danger; all the waste steam which blows off at the safety valve, and which the engines do not require, is got rid of in the same way; but I expect Mr. Hancock does not help the combustion of the fuel by thus mixing the waste steam with the flame before it acts against the boiler. Mr. Stephenson's improvement, which Mr. Gurney has adopted, is to discharge all the waste steam into the bottom of the upright chimney with a violent vertical jet, in order to accelerate the draft up the chimney. The waste steam, therefore, is mixed with the smoke and gas, after the smoke has ceased to act on the boiler. The waste steam was very commonly discharged into the bottom of the chimney, in Trevithick's high pressure engines, many years ago, in order to mix with the smoke ascending in the chimney, and thus to get rid of the waste steam; it improved the draft in that way, by rendering the smoke more buoyant, though only in a slight degree; but the waste steam was not discharged through a contracted orifice to give it velocity, nor was it directed upwards as is now done by Mr. Stephenson; whose vertical jet of steam in the centre of the chimney, gives such an intensity of draft through the fire as was never procured before, and, with the further advantage, that the rapidity of draft so produced, increases whenever the engines work faster, and discharge more steam, just in proportion as the demand for fire and steam increases by that faster working.

"Is there any noise occasioned in that way? Yes; but the sound is directed upwards by the chimney, and is not much heard in the locomotive engines on the rail-way when they are in the open air, but when they pass under the bridges, the sound is reverberated down again by the arch, and then it sounds very loud. The noise is no great consequence there, and no particular pains have been taken to avoid it. The metal pipe of the chimney has something of the effect of an organ pipe or trumpet, but it is probable the sound might be deadened."

"Will the burning out of the plates of Mr. Hancock's boiler, that you spoke of, be attended with risk of explosion of the whole boiler, or only of the smaller divisions of the boiler? It will be attended with no violence which could be called an explosion, nor with any danger whatever, but only with the inconvenience of disabling the carriage until the ruptured chamber is replaced by another. The rupture, or crack, of the metal plate at the burned place, would let out the water and steam very gradually into the fire, and probably extinguish it. All steam boilers burn out in that manner, sooner or later. The different chambers of Mr. Hancock's boiler are kept together by six very strong bolts, which pass through them all, and which are quite protected from the action of the fire; to burst the boiler those bolts must give way altogether, and there is no adequate force to produce any such effect."

"Are you acquainted with the construction of the new steam carriage which started this week from Gloucester to Cheltenham? I am not, further than that it is on Mr. Gurney's plan."

"Apprehension has been felt that these steam coaches will be found to give great annoyance to travellers passing them on the public roads, from smoke and the peculiar noise from letting off the steam; do you apprehend such results will take place? I do not anticipate any great annoyance will result to travellers in other carriages. I have passed Mr. Hancock's on the road several times, and Mr. Gurney's also, and have travelled in them often; horses take a little notice of them when in motion, but not much, and very soon become accustomed to them. I once met Mr. Hancock going very quick along the New road, and drew up to see him pass; I had no difficulty whatever in making my pony stand, though rather a spirited one. Mr. Hancock did not observe me; and as I wished to go with him, I turned and drove after him, and after a race to overtake him, I had no difficulty in drawing alongside of his steam carriage for a good way, in order to speak to him, and get him to stop for me. The emission of hot air was very sensible, when following close alongside of the boiler at the hinder end of the carriage, but I did not observe any puffing of steam."

"Do you think that whatever annoyance exists in the present steam coaches may be removed by the improvement of the carriage, and particularly the appearance of the carriage? Certainly their appearance may be improved; as they are now most unsightly. The general question of farther improvements in steam coaches depends upon the general mechanical skill and judgment of the mechanicians who turn their attention to the subject, and the peculiar experience they acquire in this particular branch of mechanics, by continually practising and exercising with steam carriages, on roads of all kinds, in all weathers, to find out their defects, and how to remedy them, and what is the best mode of management; also, by building new and better carriages as soon as they have learned what will be better than the present ones. But all this must be at a great pecuniary loss, and some further encouragement must be held out in order to induce the more skilful mechanicians to embark in such a pursuit; for, at present, it is by no means an object of attention to our best and most competent engineers, because they know they would only throw away their money and time by undertaking steam coaches, even if they were to succeed ever so completely. The patentees are a different class of men; they are the inventors who have first organized and arranged the combination of machinery which is to be used; and according to law, they have acquired a legal property in those

peculiar combinations which they have discovered, that has been their encouragement and stimulus to exertion; but the terms of their patent rights will be very likely to expire before their inventions come into use to such an extent as will repay them their previous costs with any profit thereon; and also, with the present defective state of the law on the subject of patents, they will be unusually lucky if they are able to make good their patents at law, in case their rights are contested. The patentees are not experienced mechanicians, or engineers, and have had to learn the business of engine making and of coach making as they went on; and a great deal of the deficiency of the present steam coaches has arisen from the circumstance, that they have been made by persons who were not at that time qualified to execute either a common coach or a common steam engine; but they have acquired more skill now, and we may expect more finished productions from them in future. There is no mechanician, of the class of those who will be ultimately employed to make the engines and machinery of steam coaches when they do come into use (and who alone can give that perfection of design, proportion, and execution, which is essential to their coming into use,) who will have any thing to do with them now; not so much from any doubts that they would not be able to succeed in perfecting them, as from a conviction that the expense of attaining success would be greater than would be repaid by any advantage they could afterwards derive from making such machines, in open competition with every other mechanician who chose to copy after their model when perfected; for the perfection of design, proportion, and execution, in which steam coaches are now wanting, though very laborious and expensive of attainment, would not be a ground of claim for exclusive privileges under the existing law of patents. The patents to the first inventors are the only ones which are professed to be recognised by law, though in effect they can scarcely ever be maintained at law. That is a very important point for the consideration of the committee, and one which deserves great attention. As the law of property in inventions now stands, when a new invention is advanced to such a stage that it may be considered to be tolerably perfect as an invention, no further exclusive privilege can be maintained to compensate for the skill, labour, and expense, which must be incurred to find out those true proportions, dimensions, weights and strength, which are essential to bring it to bear as a practical business. The law professes to give the whole to the first inventor, although he may have only laid the foundation on which another has raised the superstructure; and if, as usually happens, the claim of the first inventor is set aside, from technical informality in his title deeds, and also when his term expires, the whole superstructure lapses to the public. For these reasons, those who are the most competent to the task of giving the finishing touches of practical utility to great inventions, are kept back by being aware that they will not be repaid. Under such circumstances, a defect of judgment would be proved *a priori* against any one who might commence such an unpromising pursuit, and that want of judgment which could permit a man to overlook the pecuniary considerations, would not be favourable to his success as a mechanician, in giving that precision of form and dimensions, and that practical utility, to an invention which requires an exercise of the cool judgment resulting from experience, rather than of the genius depending upon original thought."

"You do not consider the inconveniences of the present steam coaches to be inseparable from the invention? Certainly not; but I do not think that any of the individuals at present engaged in the pursuit are the most competent persons who could be chosen to overcome the remaining difficulties, being inventors, who have almost completed their parts of the task, and not experienced practical engineers, into whose hands the affair of building the next steam coaches ought now to pass, under the general direction and advice of those inventors. If the building of steam coaches is continued in their hands, they will advance towards perfection of proportion and execution only by slow degrees, as the patentees acquire that general skill as engineers and mechanists which is already possessed by professional engineers."

"You think that the machinery may be improved by better mechanists? I have not the least doubt of it; and yet those mechanists are not the proper men of genius to have invented what has been hitherto done by the patentees."

"Apprehensions have been felt by trustees and surveyors of roads that steam carriages are more injurious to roads than carriages of equal weights drawn by horses; what is your opinion upon that point? I should not apprehend that the present coaches are injurious in a greater degree than other carriages of equal weights; and when steam coaches are really brought to bear, I think they will be much less so than any carriage at present in use, taking horses and the carriage they draw, against engines and the carriage they impel, at weight for weight. All my observations upon steam carriages have led me to believe that they do no particular harm to the road. I could never perceive any particular marks that they left in their tracks, and an examination of the iron tire on the edges of the wheels of Mr. Hancock's carriage, shows, evidently, that no slipping takes place on the surface of the road; which fact is proved to a certainty by other observations on the working of that carriage. It will be a long time before a sufficient number of steam carriages travel over any road to bring their effect on the materials to the test of experience; but, on general principles, I have no hesitation whatever in stating my opinion that they never will answer as long as they do injure the roads any more than the fair wear occasioned by the wheels of other carriages of the same weight; for any injury they might do to the road must be by the slipping of their wheels on the road, which would be a waste of the power of their engines, and hitherto they have had no power to spare; or, if their wheels are too narrow, and they cut deep into the road, the power of the engines will be wasted. If they are to be efficiently advanced, the whole power must be fairly exerted in advancing them forwards along the road, without turning their wheels in vain on the road, or cutting ruts in it. I am confident that, if the wheels slip at all on the roads, so as to lose motion, or if they penetrate so as to make ruts, those coaches will not answer; and therefore that the defects must be remedied, or the coaches given up. I do not mean to affirm whether the present steam coaches which draw other carriages after them, do or do not slip on the road, because I have not examined them; but I am of opinion that, for the ultimate successful application of steam power, the carriages must be so constructed that they will do less injury to the roads than carriages drawn by horses; and whenever steam coaches become common, I think the roads will be most materially benefitted by the change."

"Supposing the total weight of a stage, or mail, coach, drawn by four horses at ten miles an hour, to be two tons, and the weight of the four horses to be two tons, what proportion of the wear of a Macadam road would you expect to be occasioned by the wheels of the coach, supposing them to be the usual breadth of stage coach wheels, and what would be the wear by the horses' feet? It is impossible to fix an accurate proportion for such a question; but I have no doubt that, weight for weight, horses' feet do far more injury to a road than the wheels of a carriage, and particularly so at quick speeds, because wheels have a rolling action on the materials of the road, tending to consolidate, and the horses' feet have a scraping and digging action, tending to tear up the materials. One test of the wear by horses' feet will be in the wear of towing paths for canals, and the rail-way roads where horses are employed. In either of those cases, the number of horses which pass along is so small that no turnpike roads afford any example of comparison, and yet the wear of towing and rail-way paths is found to be considerable. The rapid wear of horses' shoes is another test."

"It has been stated, by a previous witness, that the proportion of the wear of a Macadam road, under such circumstances, would be about two-thirds by the horses, and one-third by the carriage; should you think that a fair approximation to the truth? I have no means of judging with such precision, but I have no doubt whatever that, in the case above supposed, the wear by the horses' feet would be much greater than the wear by the wheels; for, independently

of the difference of the action, as before stated; the rapidity of the blows wherewith the horses strike down their feet, in stepping quickly, wears the road, and they keep their feet pressing on the same spot for a sensible time afterwards, which must have a far greater effect on the materials, to wear and loosen them, than the comparatively progressive rolling of the wheels over the road, because the latter remain only an imperceptibly short space of time on the same spot, and have a consolidating action.

"May you take the wear of horses' shoes, in proportion to that of the tire of the wheels, as a fair test of the proportionate wear of the road by each? No, by no means; because the pressure which the wheels exert, and which wears away the tire, is, under certain conditions, very beneficial to the road; whereas the pressure occasioned by the horses' feet is in all cases pernicious. On a gravelled road, which is not yet consolidated, the rolling action which causes the wear of the tire of wheels produces a great improvement of the road, when the treading action, which causes an equal wear of horses' shoes, does nothing but mischief. The harder and more solid the road becomes, the less this may be apparent, because the wear of the road becomes so imperceptible; nevertheless, I think the proportion of less wear by wheels than by horses' shoes, will still hold true.

"What is the average width of the tire of the wheels of steam carriages which you have tried? Mr. Hancock's wheels are two inches, and three inches, broad; in Mr. Gurney's carriage, when he carried the load along with the engines, the wheels were two inches and a half broad; but I understand he has widened them since he has altered his system of drawing a separate carriage, which is to be expected as a necessary consequence of the alteration.

"Do you think the machine would act with less advantage if the wheels were wider? That depends entirely upon the weight resting upon the wheels, and the sort of roads they are to run upon. I think it would be better for those individual carriages to use broader wheels than they had.

"If the tire of Mr. Hancock's were six inches broad, would it be an advantage or a disadvantage? I think six inches would be too wide for that description of carriage; about four inches I should think a suitable width for his wheels. Mr. Hancock's carriage is so arranged, that a greater proportion of the whole weight of the carriage is thrown upon the hinder wheels, to one or both of which the power of the engines is applied, than upon the fore wheels: which I think is very judicious, because it ensures such an effectual adhesion of the hind wheels to the road, that no slipping can take place. The breadth of the wheels must be so proportioned to the pressure they exert on the road, that they will not so indent or press in, as to leave deep marks behind them. The actual breadth that will be suitable to any given weight will depend upon the hardness of the materials of which the road is made, and roads differ very much in that respect. I think that, in all cases, the breadth of wheels which will enable the carriage to make the best progress, will be that which will do the least injury to the road, for it will be that which will occasion no disturbance of the stones after they have been consolidated, but will only wear away their upper surfaces, and the iron of the tire.

[TO BE CONTINUED.]

¶ On Working Iron and Steel.

(Concluded from page 200.)

From what has now been stated, it will be seen that there are two causes for the failure of steel, more particularly if used quite hard. The first is an unequal combination of carbon with the iron, and this is more or less the case with all steel till sufficiently hammered; the toughness of some parts, the brittleness of others, and the differ-

ent states of tension hence arising, render the metal very liable to crack, if not in the hardening, yet afterwards, when forcibly struck as metal dies are.

The second cause is bad hammering; for I think I have shown above, that however much hammered, it yet may be left in a most violently conflicting state, some parts girded and pressed, while others are as powerfully strained, almost to breaking; and if hardened in this state, how can it be expected to stand? and thus springs, though very equally formed, may be very unequal in their strength.

Well hammered steel requires the least tempering to give it the necessary degree of toughness; but when hardened from a great heat, it loses all the previous condensation from the hammer, and with it so much strength that the toughness disappears, and the same hardness with less strength shows itself in brittleness. Steel, therefore, of this inferior strength, requires more letting down by tempering, to arrive at a sufficient degree of toughness to bear using. Such tools are too weak and soft for turning steel or iron, and do not stand long for any purpose.

I believe there is a given degree of cold to which the steel must be brought in a given time, to cause hardness; also a given degree from below which steel will not harden; and that all farther increase of the heat only weakens the steel, and all further increase of coldness serves only to harden a greater mass, or a deeper coat of a large mass, by cooling it in the required time.

Steel much overcharged with carbon, is too harsh, or brittle, to receive all the improvement that hammering would otherwise give it; but by choosing the most malleable steel, already sound, and hammering it at a heat so low as to be capable of holding a coat of carbonaceous matter, it will imbibe the carbon so slowly and in such small quantities during each hammering, as to enable the workman to bring it up to the fullest charge compatible with sound hammering; and so far carbon must improve the strength; but beyond that, brittleness comes on, and it refuses to receive any condensation from the hammer, by which alone toughness is given. It is of no use seeking for hardness unaccompanied by toughness, for we should have to let it down to prevent breaking; yet many believe the hardness to be increased by coming up to this brittleness; therefore, taps, dies, and turning tools, in order to increase their hardness without losing toughness, are allowed to receive a little more carbon on their surface, by putting them in red hot carbonaceous matter for the hardening, the toughness of the metal within remaining the same. For this purpose animal charcoal appears best. I have chiefly used burnt leather, which seems capable of a sort of fusion on the surface of the steel while coming to a red heat, and therefore imparts the carbon much quicker than wood charcoal; and in all cases of hardening it is best to heat the steel in close vessels, or a case of some sort, to protect it from air and prevent carbon burning out of the surface. Water damages the surface at the moment of plunging; to prevent this, small articles are frequently plunged into oil or tallow, which has the reverse effect, for it rather restores the surface. Files, and other tools that do not admit of being sharpened, are left quite hard; also tools for

cutting steel; but in all other cases, to prevent the risk of breaking, the extreme hardness is removed by tempering more or less, as the intended work will allow.

Various methods have been resorted to, in order to measure the exact temper, and more particularly for long thin articles, such as watch springs, which are difficult to heat uniformly. Melted metal, the fusing point of which is just under the right temperature, has been used; but if the mercury, or other melted metal, be in sufficient quantity, and the heat be measured by a thermometer, it will secure accuracy: the article being moved about in this till of the same heat in every part, and all through, will be well tempered, let the shape be what it may.

Heating the articles in oil till the smoke rises copiously gives a good temper for tools for brass work, and a still lower temper is given when the oil catches fire—this is called blazing off; but for articles of any substance, colour is the simplest and most direct criterion. The hardened steel is ground clean along one side, and kept perfectly free from greasiness; it is then heated, in preference at the side of a fire to avoid smoke, carefully watching the bright part until it becomes of a straw colour, it may then be cooled in water to prevent the spread of heat from parts not cared for; this temper suits tools for brass work; but if heated till it becomes brown, bordering on purple, it suits tools for pewter and very hard wood; after this it becomes blue, indicating a suitable temper for the softest carpenter's tools, table knives, and springs; it is just low enough to bear filing, and in thin pieces will bend a little before it breaks; if heated beyond this it turns gray, and is almost visibly red in the dark. Very thin springs are observed to be stiffer while the blue colour is on than when cleaned off; and on re-bluing them, they regain their stiffness, although there is no alteration of the temper; such springs are therefore preferred with the blue colour on.

These colours may be given to hard or to soft steel, and when cleaned off, the same heat will always restore them. The steel and screws of watches are generally blued for ornament; the other colours, when given merely as a guide in the tempering, are cleaned off. I have found the slow conducting power of lamp black a useful agent to preserve particular portions from being hardened with the rest.

It is sometimes desired to harden the neck of a mandril and not the screw, lest it should break when roughly used: this may be done by an iron tube fitted a little way on the neck of the mandril, and ramming the space between full of lamp black, so as completely to envelop the screw, then shut it in by a disk to serve as a wadding; the mandril being then made red hot, and plunged in water, the exposed part will be hard, and the covered screw will remain soft.

Steel hardens as well under cover, as if exposed, provided it can be cooled in the requisite time; small articles, for watch work, have accordingly been hardened quite clean, and their brightness preserved, by filling a brass box with them, capable of being shut air-tight while in the fire, and then plunging the box with its contents in the water. On opening the box when cold, the articles are found hard

and clean. Very fine drills or wire may be hardened from the flame of a lamp or candle, by merely shaking them quickly in the air, as that will cool them soon enough. Large masses require rapid motion in cold water to enforce their cooling in the requisite time. The largest masses that can be hardened are best done under a waterfall, the force of which beats away the steam as fast as formed, and keeps the surface cool while the central heat is escaping through it; and they should remain in this situation till quite cold throughout; if taken out sooner, the central heat will spread to the inner side of the hard shell and expand it, while the outside may be cold, and therefore will be liable to burst.

I met with an evident case of cracking, when hardening from badly hammered steel which also was unequally carbonized. The pieces were ovals, one inch long, filed out of steel bars one-tenth of an inch thick; they were then hammered, which condensed the middle and stretched the outside; in this state, they were heated in a crucible full of charcoal powder, (which probably carbonized the outer edge most,) and hardened by plunging in water; this cracked them all in the middle, the most condensed part, and none of the cracks extended to the outside.

Stamps and medal dies are an important application of steel; and to enable them to be hardened sound, and to stand in use when hardened, requires the metal to be in a state of perfect ease, the result of equal condensation all through, and this can best be secured by hammering in a recess.

For this purpose, it would be very desirable to ascertain, by experiments, the greatest thickness that can be hardened all through; also the state of carbonization most favourable to the greatest thickness; or, what is the precise difference in this respect between the most mild steel and that which is highly charged with carbon. Likewise, in very large masses, what is the greatest depth from the surface that can be hardened, and whether greatly hammering it would cause any difference in the thickness of the hard crust. This would of course require the pieces so hardened, to be afterwards broken to examine the interior; and where a soft nucleus occurred, it would require to be ground flat, to show what sort of boundary there would be between the hard and the soft parts; for it would be rendered visible by the very different texture which grinding produces in hard and in soft steel; and there must be some difference in the durability of a block, according as the boundary is well, or ill, defined.

We are so familiar with small flaws in articles of iron as scarcely to notice them, for their cheapness enables us to use the good and throw away the bad—such as nails, brads, screws, &c.; but our attention is drawn to large flaws, from the serious consequences likely to attend their giving way.

But in steel nearly the reverse takes place, as it is used so much smaller than iron, in things of consequence; therefore the smallest flaws are frequently of as much importance as the largest, for they occasion the breaking of tools, frequently spoiling the work; and when

small work is nearly finished, hidden flaws destroy it; they also help to crack large masses when hardening.

But when the utmost efforts of the human mind are transmitted to steel plates, from which the delights of peace and civilization are spread abroad, it becomes of the greatest consequence to avoid every flaw, and even chemical dissimilarity; for though the metal be sound, it may be so unequal in its nature as to etch very badly, and the smallest flaws will spread very broad while drawing into thin plates; and when the etching, or graving, reaches through to such a flaw, the work is spoiled; laminæ of engraved work frequently coming off, as engravers have already seriously experienced.

For such works, therefore, cast steel should be employed: it should receive an extra degree of forging, most perfectly to equalize its composition, and reduce it to a mild state, for on this depends good etching; then the surface should be watched and kept clear, while reducing it to a usable thickness, that no flaws may be beat in: all welding must likewise be avoided, for fear of shutting in flaws; and if rolled into plates, it will require good hammering afterwards to restore the strength, or soundness, which it loses laterally while rolling. The especial reason why the primary forging should be long and carefully performed, is, that the etching is liable to be rough or smooth, as perfect homogeneity is more or less obtained, and it will be cloudy if different parts of the plate differ in their dose of carbon.

It would be desirable for engravers to make themselves well acquainted with the difference of action of the same acid on pure decarbonized steel, on ordinary steel, and on highly carbonized steel, and also on steel in the softest as well as in the most condensed state; for they would thus judge better whether the defects were in the metal or the acid.

CORNELIUS VARLEY.

[*Trans. of Soc. for Encouragement of Arts.*

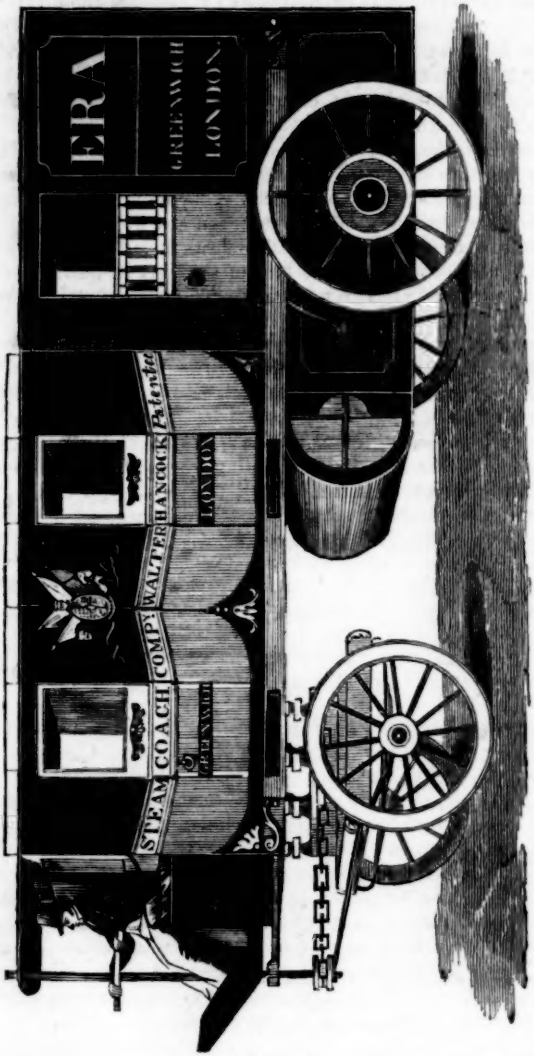
¶ *Iron Roofing.*

Your correspondent, at Peterhoff, has not given you the best mode of covering an iron roof, to prevent its rusting. Coal tar, brought to 220 degrees of Fah. and mixed with red lead, (genuine,) in the proportion of eight of tar to one part of lead, forms a composition which resists oxidation of the iron plates, or wrought iron of any shape, better than any other material whatever. Oil, and every mixture of metallic oxides with oil, give to wrought iron a tendency to scale off in large flakes when subjected to changes of temperature. At the present price of iron, it is much cheaper to cover a roof with sheets of that metal than with any other material whatever—and more especially where the plates are coated under and over with the above composition. Fine sand must be strewed on the surface, quite dry, and the work must be executed in dry weather.

[*Mech. Mag.*

¶ *Hancock's Steam Carriage.*

The annexed engraving represents a new steam carriage, which Mr. Walter Hancock has just built to run on the road between London and Greenwich.



For the following particulars of its construction, we are indebted to Mr. Gordon's valuable Historical and Practical Treatise.

There are two engines, which are placed before the boiler and turned with the stuffing box down, so that the cylinders are uppermost, and the piston and connecting rods below. The crank shaft, with two cranks, is supported by a flexible frame, which provides for any concussion on rough roads. A chain passes over a sheave on the crank shaft, and over a larger sheave on the hind axletree. The wheels turn loose on the axle, and one or other, or both, are fixed by a clutch when required. This clutch is on the outside of the wheel, and can be screwed out, or in, as the case demands, with great facility. The turning of the carriage round to the offside, is prepared for by throwing out the off side clutch, and keeping in the near one; and the turn round to the near side, is prepared for by throwing out the near clutch, and throwing in the off side clutch. A little play is left between the catches in each clutch, so that a winding road may not oblige either wheel to be disengaged; and it is only in a short turn, or a turn round, that the clutch must be shifted, and this can be done in a very small space of time.

Fig. 2.

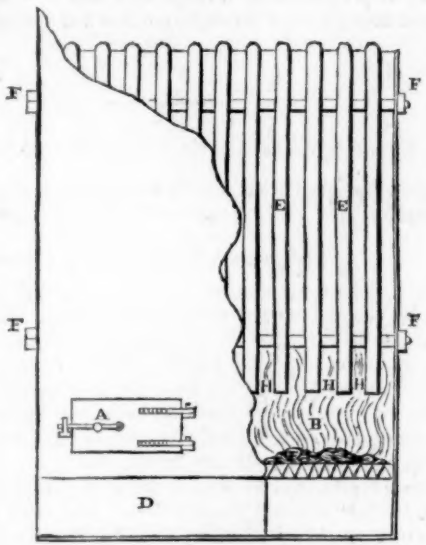


Fig. 2 is an elevation of the boiler, with part of the casing removed for the purpose of exhibiting the interior structure. A is one of the fire doors, of which there are two. B the fire place; D the stoke-hole; E E the chambers, constructed of the best wrought iron; F F shows the manner in which all the chambers are bolted together, so as to form a large boiler of many compartments. There are fillets of iron, which keep the individual compartments at a proper distance

from each other; and these spaces which the fillets leave are the flues of the boiler, through which the flames ascend as shown at H H H. All these compartments are connected at the bottom for the purpose of keeping the water in each at the proper level; and at the top the steam is conveyed from each by as many pipes as there are chambers into the steam feed pipe, by which the steam is conveyed to the engines. By this arrangement, the only parts of the boiler which can be dreaded are the sides; but good ties will keep them together. And as to the bottom end, and top of the boiler, which are composed of the edges of these compartments, if one part is burnt out or hurt, it is only that individual compartment which can burst, and its power of doing mischief is not worth notice. The fire is urged by a blower, which is driven by a connexion with the engines. The waste steam is blown from the engines into the chimney, and so destroyed. The passengers are carried on the same machine, Mr. Hancock preferring that disposal of the weight to the dragging of it in a carriage behind. The wheels of the carriage are a beautiful exhibition of strength and lightness combined. The spokes are all wedge shaped, and where they are fastened into the nave, abut against each other. Their escape laterally is prevented by a large iron disc at each end of the nave; and these being bolted through, confine the spokes securely in their places.

[*Mech. Mag.*

¶ *Mr. Gurney's Steam Carriage, applied to rail-ways.*

We have been favoured with the following copy of a letter from William Crawshay, Esq. to Lieutenant-Colonel Sir C. Dance—

Cyfaithfa Iron works, 23*d February*, 1832.

My Dear Sir,—I regret that my occupation at this moment prevents me giving you the ample reply I could wish, to your inquiry as to the working of Mr. Gurney's engine on our rail-road at Hirwain. I can, however, state to you in general terms, that the favourable opinion entertained by my engineer and myself of the tubular boiler, over every other we have yet seen, not only remains unshaken, but is strengthened and confirmed by eighteen months constant use and observation of it on our own road; and, also, by all we can collect from other testimony, of what is doing elsewhere in this neighbourhood with boilers of other description. The ease and economy of first construction, the facility of repair when required, the extreme lightness, the great capacity for raising steam, and the perfect freedom from danger of the tubular boiler, all render it, in our opinions, pre-eminently adapted to locomotive engines; and I hope in the course of a few months, to apply it to engines and carriages, suited to rail-roads and heavy work, so successfully as to render the advantage of steam power over that of horses, still greater than it now is. As, however, facts of past performances of any kind are more satisfactory than anticipations of the future, I beg to state to you, that in

the past twelve months, between the 1st day of January, 1831, and the 1st day of January, 1832, the locomotive engine which I bought of Mr. Gurney, weighing only thirty-five cwt. including every thing whatever belonging to it, with water and fuel in a working state, conveyed 42,300 tons of coal, iron stone, and iron, exclusive of the carriages on which they were drawn, the distance of two and a half miles upon our rail-road at Hirwain, in journeys of from twenty to thirty tons, as suited our convenience; during which time the entire consumption of coal was 299 tons, which at 3s. per ton, amounts to £44 17s. The wages of the engineer £52, and those of the boy £15 12s. together, exclusive of the trifling repair of the engine, and the oil and other little matters required for its use, £112 9s. or less than one farthing per ton per mile, for the goods conveyed; and I must not omit to observe to you, that had there been nearly double the work to do on this road, the engine would have done it with little or no increased expense, as she was invariably working idle, for the purpose of keeping the boiler full, about one-half of her time.

You are sufficiently acquainted with the experience of horse power to render any comparison on my part unnecessary, but from the observations I have been enabled to make, in contrasting horse power with that of steam on the same road, I should certainly consider that the average of horse power, compared with that of steam under the most improved application, is, in point of expense, as twenty or even thirty to one: independently of many other valuable considerations in favour of that of steam, known only to those who have large and expensive stable establishments, in which valuable horses, after sustaining hard work all day, are exposed to the negligence, roguery, and ignorance of hawliers, horse-keepers, and farriers, while the engine, having completed her day's work, may be left without anxiety as to the attention of any of these notoriously troublesome persons until again called into use.

I consider that the unprecedented depression of the iron trade, and the late disturbances in South Wales, have much impeded the further introduction, use, and improvement, of locomotive engines in this part of the country; and it is a matter much to be regretted, that more talent, competition, and energy, are not at this moment excited every where in the furtherance of so great a national advantage as the substitution of the cheaper power of steam, wherever practicable, for that of horses.

Wishing you every success in your zealous perseverance in this laudable object.

I am, sir, yours, &c.

WILLIAM CRAWSHAY.

[*Mech. Mag.*

Swing Hone.

The thanks of the Society in London for the Encouragement of Arts, &c. were voted to Mr. J. Fayrer, of Pentonville, for his swing hone for sharpening razors and other articles of cutlery. One of the hones has been placed in the Society's Repository.

The exquisite edge given by the cutler to razors, lancets, and other fine cutting instruments, can rarely be produced by those persons who are in the habit of using them. This arises partly from ignorance of the properties in which consists the difference between a good and a bad hone, and partly from want of that skill and slight of hand in the use of a hone, which long and constant practice only can give in perfection. Mr. Fayrer's hone is a plate of brass, about an inch wide, and of any convenient length, ground to a perfectly smooth surface on both sides; part of each end is cut or filed away, leaving only two pins, or pivots, on which the hone turns or swings. In the frame are two uprights with notches to receive the pivots. Two boxes are provided, one to hold a coarser and the other a finer powder made of oil-stone ground down and washed over: for the latter, finely pounded water-of-Air-stone may be conveniently substituted.

To use the hone, first put on one of its sides a few drops of oil and a little of the rougher or coarser powder, then draw along it, in the usual manner, the edge of the razor or other tool to be sharpened. As the hone swings on two pivots, the surface necessarily applies itself quite evenly along the edge of the blade, in whatever direction the pressure of the hand is made that holds the tool; and the particles of the powder, as the operation proceeds, are continually becoming smaller and smaller, and therefore giving a finer and finer edge to the tool or blade. To finish the setting, turn uppermost the other surface of the hone, apply to it oil and the finer powder, and proceed as before.

Metal plates, both of steel and of tin, have already been made to serve the purpose of hones; but the application of brass as a material for this purpose seems to be new, as well as the contrivance of hanging it on pivots, in order to accommodate itself to the varying pressure of the hand. [*Trans. of Soc. for Encour. of Arts.*

TRANSLATIONS FROM FOREIGN JOURNALS.

New rollers for Inking Lithographic Stones.

[Translated for this Journal.*]

The rollers used in lithography for inking the stones, consist generally of cylinders of wood covered with calf skin, and stuffed with carded wool. Besides the inequalities which the surfaces of such rollers present, the seam uniting the two sides of the leather makes a ridge which spoils the uniformity of the inking, particularly when

* By request of the Committee on Publications.

large stones are used. This has hitherto been a great obstacle in the progress of the lithographic art. This ridge had been reduced, and practice had taught a method of concealing, in part, the defects necessarily attendant upon the use of rollers with seams; but the inconvenience and many defects still remained to be remedied. M. Tudot, incited by an appeal of the Society for the Encouragement of National Industry, conceived the idea of making rollers of round plates of different substances cut with a punch, then threaded together on a cylinder of wood, pressed forcibly one against the other, and polished or trimmed. He has tried in this way chamois leather, calico, and calf skin. This last material answered best, and furnished rollers which were soft, without seams, and which distributed the ink uniformly. M. de Lasteyrie, a competent judge in these matters, observes that the ordinary (seamed) rollers are very quickly worn out, while those of M. T. will not be exposed to the operation of the same causes of wear and tear, and will, therefore, greatly outlast the others.

The new rollers are rather higher priced than the common ones, but it is confidently expected that their continued manufacture will admit of a reduction in the price. M. Tudot has received a prize of 500 francs ($100) for the ingenuity displayed in his invention.

[*Mémorial Encyclopédique, &c.*

Method of removing Acid from the papers used in Lithographic Printing.

Most of the paper used in copperplate and lithographic printing has an acid reaction, due, doubtless, to the processes of whitening, or to the alum used in its manufacture. This acid soon injures the texture of the lithographic stones, and after, at most, thirty impressions have been taken, the stone *greases*, to use the expression of the workmen, and the impressions are imperfect. M. Joumar remedies this greasing of the stone, in a very simple way; he passes the paper intended to receive the impression, through weak lime water, which neutralizes the acidity; he leaves it through the night thus wet and *matted*, and on the following morning either dries it or takes off the superabundant moisture, keeping that degree of softness which the printing requires. The author of this simple and easy method of removing the acid from lithographic papers, has received a medal of the value of 200 francs, ($40.) [*Ibid.*

Lithography in imitation of Mezzotint.

Various attempts have been made to imitate the style of mezzotinto engraving by lithography. One of the methods tried was by *tamping*. This process had given some beautiful results, but the mellowness of the tints could not be obtained. Besides, in sketching

on the stones and removing the superabundant ink with the scraper, for the clear parts, the grain of the stone was destroyed, and when the stone was heated, for the purpose of fixing the sketch upon it, a few engravings with tarnished and gluey tints were all that could be obtained. M. Tudot proposes another process in which the scraper is not used. He lays the lithographic ink on the stone with care, makes it penetrate into the grain by means of an instrument of horn, then with a point of ivory, or, in preference, with a small utensil composed of very fine and pointed threads of steel, he takes from the bottom of the grain as much of the crayon as he thinks necessary to produce the desired tints. This process, put in practice by able workmen, has produced designs rivalling in every particular engravings which have come from the hands of the most celebrated engravers in mezzotint. The artist, while transferring to the stone the conceptions of his genius, has every desirable freedom, is not embarrassed with any mechanical operation, and the process is very rapidly executed. In some trials, made in presence of the Society for the Encouragement of National Industry, the 800th impression was as beautiful as the first. M. Tudot has received for this application a gold medal of the value of 2000 francs, ($400.)

[*Bulletin of Soc. for Encour. of Nat. Ind., &c.* 20 *Dec. and Ibid.*

Cure for Painter's Colic.

Plumbers, manufacturers of white lead, painters, printers, &c. and, generally, all persons exposed to the action of lead, are subject to this colic. Many remedies have been employed in this complaint; the one most generally adopted, and which has been attended with constant success, consists in administering emetics and purgatives. This method is obviously troublesome, and is besides expensive. M. Gendrin has communicated to the Academy of Sciences, a new remedy, viz. the acid sulphate of alumina and potassa, or common alum, dissolved in a sufficient quantity of water, and given in a dose of from one to three grains a day. This mode of treatment had been before recommended by Adair, Michaelis, &c. and is now in general use at the hospital of St. Anthony. The alum thus taken cures the malady completely in the space of from three to five days, without in the least weakening the organs of digestion. Its use in a dose of from one to one and a half grains,* is still more beneficial at the commencement of the attack; twelve or fifteen hours are then sufficient to remove all the symptoms. M. G. considers the efficacy of the alum to be probably due to the sulphuric acid, which enters into its composition. In fact, a sulphuric lemonade, made of one grost to $1\frac{1}{2}$ of acid, in twelve litres‡ of water, given to persons suffering under the painter's colic, has produced a complete and speedy cure. The sulphuric acid thus used with water as a lemonade, is as well as the alum, a sure preventive if taken on the first symptoms of the

* French, 2-3ds of a grain troy. † 54 troy grains. ‡ $25\frac{1}{2}$ pints.

attack. If these simple receipts for the prevention and cure of a terrible complaint, are supported by further experience, M. G. will have rendered a great service to many useful and laborious classes of manufacturers and artists. [*Ibid.*

Prizes awarded by the Society for the Encouragement of National Industry.

On the 28th December the Society for the Encouragement of National Industry held its public semi-annual meeting for the year 1831. Of twenty-one competitors for the prize offered for the best means of security against the explosions of steam boilers, and for such a form of boiler as would guard against the effects of such explosions, no one obtained the prize. Silver medals were awarded to the following persons—M. Hall, of Paris, for a combined safety valve and fusible plate: M. Roux, for a new kind of feeding pump; and M. Trimot, engineer and maker of steam engines, for his water gauge tube, and fusible plate applied to the boiler. [*Ibid.*

Laws of Friction.

Notwithstanding the ability of Coulomb, and the care which he bestowed upon all his experiments, his researches upon the subject of friction, the results of which are given in the memoirs of the French academy for 1785, were incomplete, and, in some respects, contradictory, and their accuracy has been, in consequence, suspected. The researches since made upon the same subject by Rennie, Vince, and others, have neither been sufficiently extensive nor precise to set the question at rest. Mr. Morin, by means of an apparatus better calculated for giving precise results than that of Coulomb, has lately made a new set of experiments, varying the velocity from the lowest up to ten feet and upwards a second. The rubbing surfaces also varied from some tenths of a square inch to nearly five hundred square inches, and the pressures from ninety pounds to 2000 lbs., and were carried even as high as 2500 lbs. All the experiments made within these limits agree in showing that the friction of surfaces moving on each other, is independent both of the velocity and the surface, and proportional to the pressure. Coulomb, it is true, had already inferred these laws, but he stated many exceptions to them, which, according to the present researches, do not exist. Coulomb supposed that in the case of oak moving over oak, the grain of the wood all running the same way and in the direction of the motion, the relation of friction to pressure was 11 per cent., while Mr. Morin found it to be 48 and 32. Mr. Morin found for elm running over oak 48, when the fibres are parallel, and 41 when they are perpendicular. He also rectifies the mistake of mechanics who believe the friction to be less between heterogenous substances than between those of the same kind, and

shows that the friction of metals on wood is greater than that of oak on oak; thus when iron is made to move over oak, the ratio is .61; and in the case of copper over the same wood, the ratio rises to .62. These interesting experiments, a report upon which is to be made to the academy by Messrs. Poisson, Arago, and Navier, will be continued by the author, who intends to obtain, if it be possible, the coefficient of friction for all the materials employed in the mechanic arts, in building, &c. [*Academy of Sciences*, 12 *Dec.*

Compensating Pendulums.

After the pendulum was applied as a regulator to clocks, and the other parts of these instruments had been rendered perfect in their construction, so great a regularity was obtained that the variations caused by the expansion and contraction of the rod of the pendulum, became sensible. M. Henry Robert, clockmaker at the palais royal, and pupil of Braguet, has lately communicated to the Society for the Encouragement of National Industry, a more simple method than that in use for obtaining an exact compensation in pendulums beating the half second. The common method of compensation is to make the rod of the half second pendulum of a single platinum tube, and the bob of zinc; the difference in the expansions of these two metals is such, that by exact calculations a perfect correction is obtained. Robert directed his attention to the pendulum with a wooden rod, for the purpose of using it in ornamental time pieces, for which the zinc and platinum pendulum (gridiron) was unsuited, from the comparative plainness of its appearance. By a simple and easy device he has so constructed it as to protect it completely from the action of the atmosphere, so that it may now be substituted for the best metallic compensators, in every kind of clock. In the construction of this new pendulum, M. R. profiting, on the one hand, by the well known property possessed by the wood of the fir tree, of preserving its length unaltered in all changes of temperature, has been enabled to confine his attention simply to its tendency to warp, by the absorption of moisture from the atmosphere, and to prevent this encloses the rod made of this wood in a metal box; the expansion of the bob corrects that of the tube.

This simple pendulum unites all the requisites of a good compensator, while at the same time it may be put together with ease; it takes up little room, is of a very simple form, and may be placed in the most beautiful models where the pendulum is exposed to view.

[*Ibid.*

Preservation of Wood.

A method of preserving building timber from decay has long been a desideratum. The attempts hitherto made, have not, however,

been attended with success. Timber for ship building is subject to a peculiar species of decay, called the *dry rot*, a method of preventing which would be exceedingly valuable. At the meeting of the Society for the Encouragement of National Industry, on the 21st December, Mr. Bréant, Assayer of the Mint, and an able chemist, exhibited several pieces of wood of many inches square, and several feet long, which had been prepared by him according to a new process, which is expected to preserve them from every species of decay. The details of the method have not been made public by M. B.; he has merely stated that the wood is soaked in saline solutions and in oily and resinous matters. These substances penetrate so completely throughout the mass of the wood, that when one of the blocks exhibited before the society was sawed in half in presence of the members, it was found to be thoroughly impregnated with them even to its very centre. M. B.'s process requires but two or three days for completion, even in blocks of wood of a large size. If further experience confirm what science has thus suggested, the difficult problem of the preservation of wood may be considered as solved. M. B. states that he will shortly be able to furnish timber of all sizes prepared in this way. [*Ibid.*

New method of determining the Strength of Bleaching Salts.

We have already described several processes of different degrees of exactness, for determining the strength of bleaching salts,* and now give another which, though not very accurate, is exceedingly simple, and may be executed by every one. If we pour into a graduated tube, one measure of common ink, and then add successively, proceeding by *fourths*, $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, &c. measures of water, we shall of course obtain inks more and more pale in the same proportion. Lines are to be drawn very near together on a sheet of paper, with the inks thus obtained; that is, for the sake of convenience, a line is to be drawn after each addition of the water, which method will readily give us lines growing regularly paler and paler in a fixed proportion. When this is done, we are to cut off with a punch, of the same size, small disks of the paper thus ruled, so that each disk shall contain lines of all the different strengths, from the deepest to the palest. If we now wish to determine comparatively the strength of a sample of chloride of lime (bleaching salts) we have only to take a small quantity of it, and wet it sufficiently to make a conical cake, the base of which must cover exactly one of the pieces of paper, upon which it must be suffered to stand for about five minutes. The number of lines effaced will then give the comparative strength of the chloride. As these trials are only comparative, we must always make use of the same ink; and a trial should have been previously made with paper ruled by it, and bleaching powder, the strength of which had been accurately determined by other methods; this previous trial furnishes

* See this Journal vol. ix. p. 211 and 337, vol. x. p. 181, &c.

us with our standard of comparison. In the case of bleaching liquors (as Labarraque's disinfecting soda liquid, or the chloride of soda, &c.) a given quantity must be poured into a graduated tube; the trial piece of paper is then to be introduced into the same, and there to remain for a determinate space of time, to be acted on by the liquid. While the action is going on, it is better to cover the piece of paper by a wine glass or tumbler. Some chloride of lime furnished by Mr. de Rezé, from the mines of de Vic, erased completely all the lines from a piece of paper, while the best chloride (of commerce) of Paris, destroyed only $\frac{35}{40}$ths of the lines of a piece of paper ruled with the same ink. [*Ibid.*

W.

Meteorological Observations for July, 1832.

Moon. Day's		Therm. Sun rise	Therm. 2 P. M.	Barometer. Sun rise.	Barometer. 2 P. M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches				Inches.	
☽	1	66°	79°	30.00	30.00	66	S.	Moderate.	.10	Drizzle—cloudy.
	2	65	86	.00	.00	65	SW.	do.	.30	Rain—flying clouds.
	3	62	84	.5	.03	63	W.	do.		Clear—rain in the night.
	4	71	86	29.90	29.90	75	W.	Calm.	1.30	Fog—it clds. rain in n't.
	5	71	81	.85	.90	71	SE.	Moderate.	.2	Rain—flying clouds.
	6	67	83	.90	30.00	71	W.	do.	.52	Cl'dy; fly'g cl'ds; slight sh
	7	73	85	30.00	29.90	73	SW.	do.		Fog; fly'g cl'ds, thund. sh.
	8	73	87	29.85	.80	74	SW.	do.	.55	Drizzle; flying cl'ds. rain.
	9	68	84	.70	.70	68	SW.	do.		Rain—flying clouds.
	10	68	76	.65	.70	68	SW.	do.		Cloudy—flying clouds.
	11	69	79	30.00	30.05	69	W.	do.		Clear day.
☉	12	69	82	.10	.10	69	W.	do.		Fog—clear.
	13	68	85	.4	.4	67	SW.	Breeze.		Fog—clear.
	14	71	85	.00	.10	71	SW.	do.		Cloudy—clear.
	15	74	85	29.90	29.90	73	SW.	do.		Fog—clear.
	16	71	83	.90	.80	73	SE.	do.		Cloudy—clear.
	17	71	83	30.00	.85	73	SW.	do.	1.35	Clear—showery.
	18	69	63	29.80	30.5	58	NE. SE	do.		Rain—cloudy.
☾	19	71	77	30.00	29.70	61	S.	Blustering.		Cloudy day—rain.
	20	66	76	.5	30.5	59	W.	Moderate.	.15	Drizzle—flying clouds.
	21	61	76	.5	.5	62	SW.	do.		Clear day.
	22	63	76	29.84	29.80	64	S.	do.		Clear—cloudy.
	23	65	79	.74	.74	61	W.	Breeze.		Drizzle—flying clouds.
	24	59	79	.90	.90	55	W.	do.		Clear day.
	25	52	79	30.10	30.10	38	NW.	Calm.		Clear—light clouds.
	26	50	70	.10	.10	47	W.	do.		Clear day.
	27	52	74	29.93	29.93	56	W.	do.		Clear day—sun eclipsed.
	28	69	76	.90	.90	61	SSE.	do.		Cloudy day.
	29	68	80	.94	30.00	66	SE. W.	Breeze.	.1	Drizzle—clear.
	30	63	80	30.00	.00	69	SW.	do.		Fog—clear.
	31	64	86	29.94	29.90	73	W.	do.	.50	Fog—thunder shower.
	Mean	65.10	78.26	29.93	29.93	64.4			5.40	

	Thermometer.	Barometer.
Maximum height during the month,	86. on 2d, 4th & 31st.	30. 10 on 12th, 14th, 25th & 26th
Minimum do.	50. on 26th.	29.65 on 10th.
Mean do.	71.73	29.93